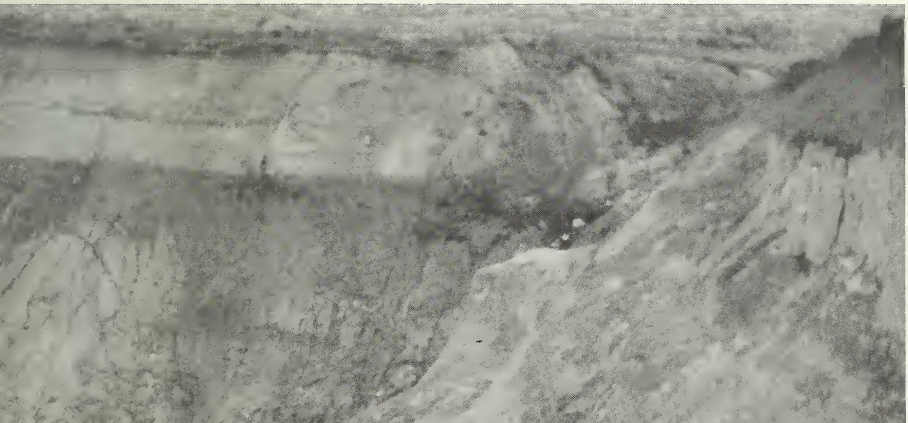
WEDRON AND MASON GROUPS:
Lithostratigraphic Reclassification of Deposits of the Wisconsin Episode, Lake Michigan Lobe Area

Ardith K. Hansel
W. Hilton Johnson



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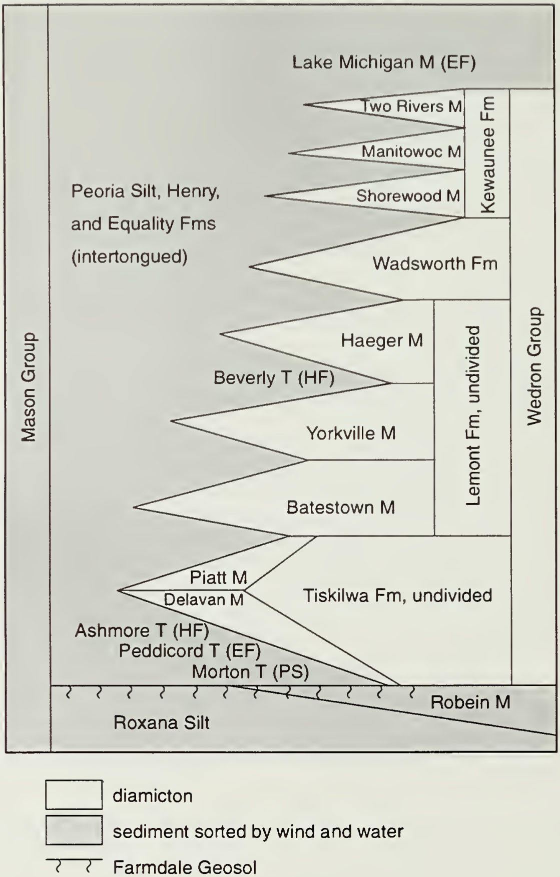

Mason Group
Equality Fm (EF)
Lake Michigan M
Peddicord T
Henry Fm (HF)
Beverly T
Ashmore T
Peoria Silt (PS)
Morton T
Roxana Silt
Robein M

Wedron Group
Kewaunee Fm
Two Rivers M
Manitowoc M
Shorewood M
Wadsworth Fm
Lemont Fm
Haeger M
Yorkville M
Batestown M
Tiskilwa Fm
Piatt M
Delavan M

Stratigraphic relationships of the Mason and Wedron Group units

D. Nelson

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We also thank Chao-Li (Jack) Liu and staff of the ISGS Isotope Geochemistry Laboratory, who through the years have supported Quaternary studies by providing radiocarbon ages and analyses for Quaternary samples. We appreciate their interest in helping us understand the Quaternary record, as well as their prompt service and willingness to make available unpublished data.

Cover photo Intertongued Wedron and Mason Group deposits at Wedron Quarry, pit 6.

ILLINOIS DEPARTMENT OF NATURAL RESOURCES

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PLATE 1

Areal distribution of the Wedron and Mason Groups (Wisconsin and Hudson Episodes) and deposits of the Illinois and pre-Illinois episodes in Illinois vii

Plate 1 Areal distribution of the Wedron and Mason Groups (Wisconsin and Hudson Episodes) and deposits of the Illinois and pre-Illinois episodes in Illinois. Episodes are diachronic temporal units.

Quaternary Deposits of Illinois

revised by

Ardith K. Hansel and W. Hilton Johnson

1996

Hudson and Wisconsin Episodes

Mason Group and Cahokia Fm

- Cahokia and Henry Fms; sorted sediment including waterlain river sediment and windblown and beach sand
- Equality Fm; fine grained sediment deposited in lakes
- 5 — Thickness of Peoria and Roxana Silts; silt deposited as loess (5-foot contour interval)

Wedron Group (Tiskilwa, Lemont, and Wadsworth Fms) and Trafalgar Fm; diamicton deposited as till and ice-marginal sediment

- End moraine
- Ground moraine

Illinois Episode

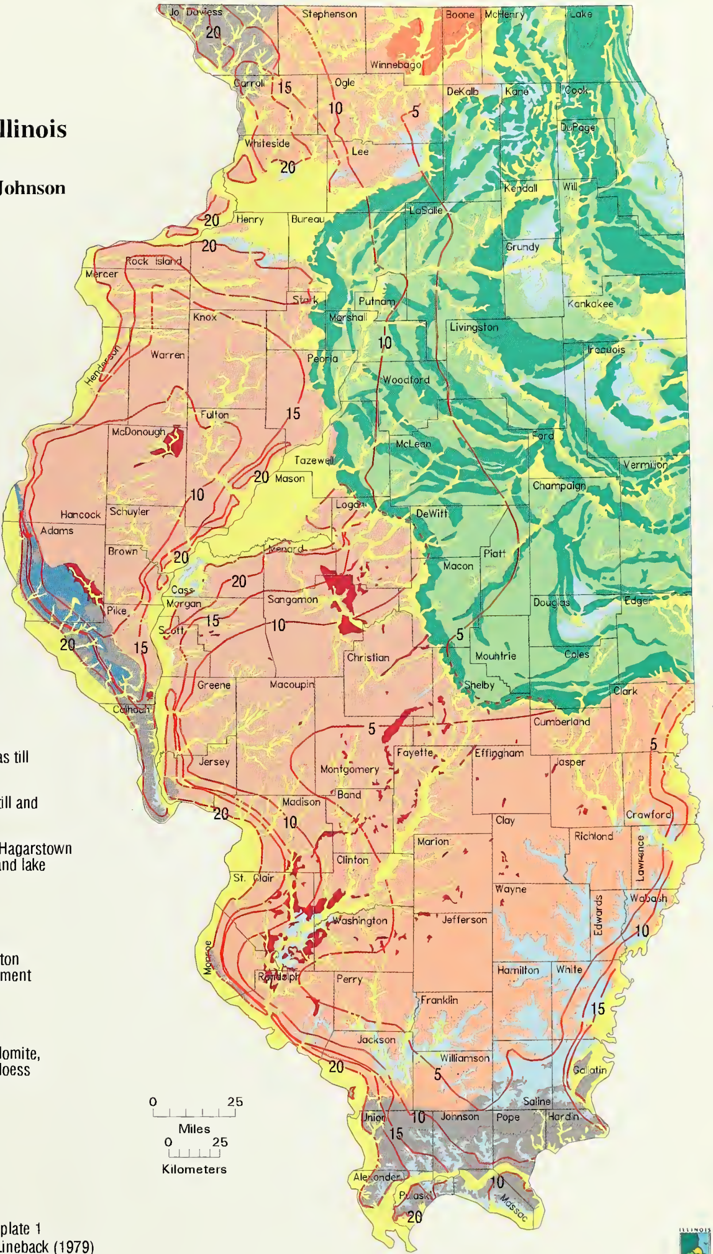
- Winnebago Fm; diamicton deposited as till and ice-marginal sediment
- Glasford Fm; diamicton deposited as till and ice-marginal sediment
- Teneriffe Silt and Pearl Fm, including Hagarstown Mbr; sorted sediment including river and lake deposits and wind-blown sand

Pre-Illinois Episodes

- Wolf Creek Fm; predominantly diamicton deposited as till and ice-marginal sediment

Paleozoic, Mesozoic, and Cenozoic

- Mostly Paleozoic shale, limestone, dolomite, or sandstone; exposed or covered by loess and/or residuum



Illinois State Geological Survey Bulletin 104, plate 1
Revised from Willman and Frye (1970) and Lineback (1979)
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ABSTRACT

Deposits of the last glacial episode blanket most of Illinois and Lake Michigan and reach thicknesses more than 100 meters (328 ft) in some large end moraines. These deposits, studied scientifically for more than 125 years, were classified as the Wisconsinan Stage in *Pleistocene Stratigraphy of Illinois* (Willman and Frye 1970). As the result of many new research projects in the past 25 years, knowledge of the lithology, distribution, and correlation of the deposits of the Wisconsin glaciation has increased significantly. This new information needed to be synthesized, and the classification system needed to be revised to make it practical for both basic and applied scientific investigations. The revision presented in this report builds on the classification of Willman and Frye and follows the guidelines of the North American Stratigraphic Code.

The idea for this revision began more than a decade ago with the intent of reinstating the formation as the basic unit in Quaternary lithostratigraphy in Illinois. This change involved raising the rank of till members, the basic units used to describe, map, and interpret regional geology in northeastern Illinois, to formations and elevating the Wedron Formation to group rank. Demand for detailed geologic maps and cross sections in applied work led us to restructure the basic lithostratigraphic framework for classifying the deposits of the last glaciation. In Willman and Frye's classification, buried sorted-sediment units, except for loess units, are treated as informal facies of till units, a practice that has tended to deemphasize their importance. The distribution and correlation of the subsurface sorted-sediment units are critical, however, for most practical applications, as well as for understanding glacial history. In the classification of this report, tongues of sorted sediment are included in the sorted-sediment formations.

Deposits of the newly established Wisconsin Episode of glaciation record migrating proglacial and glacial environments in Illinois and Lake Michigan. These deposits are classified in two intertonguing groups. The diamictons, including till and ice-marginal deposits, are classified in the Wedron Group, whereas the proglacial sorted-sediment deposits, mainly loess, eolian sand, lake sediment, and outwash, are classified in the newly established Mason Group.

The Wedron Group is divided into four formations. In ascending order, they are the Tiskilwa, Lemont, Wadsworth, and Kewaunee Formations. Two members, the Delavan and Piatt, are recognized in the Tiskilwa Formation; three members, the Batestown, Yorkville, and Haeger, are in the Lemont Formation; three members, the Shorewood, Manitowoc, and Two Rivers, are recognized in the Kewaunee Formation. The Wadsworth Formation is not subdivided. Other units formerly classified as members of the Wedron Formation are reclassified or dropped for reasons of synonymy.

Four formations, the Roxana Silt, Peoria Silt, Henry, and Equality, are differentiated in the Mason Group. These formations are defined on the basis of stratigraphic position and/or lithology. The upper organic-rich part of the Roxana Silt is classified as the Robein Member. The tongue of the Peoria Silt that occurs beneath the Tiskilwa Formation is formally recognized as the Morton Tongue. Two tongues of the Henry Formation are formalized: the Ashmore Tongue, which occurs below the Tiskilwa Formation, and the Beverly Tongue, which occurs below the Haeger Member of the Lemont Formation. The tongue of the Equality Formation that occurs beneath the Tiskilwa Formation is formally recognized as the Peddicord Tongue. The upper gray part of the former Lake Michigan Formation is classified as the Lake Michigan Member of the Equality Formation; it is confined to Lake Michigan. The former morphogenetic and/or lithogenetic members of the Henry and Equality Formations are not retained as formal units. Like the former Parkland Sand, they are treated as informal sedimentary or morphogenetic facies of other Mason Group formations.

The temporal classification in this report differs from that in previous reports. The lithostratigraphic and pedostratigraphic units on which the Wisconsin Episode is based are clearly time-transgressive (diachronous); therefore, a diachronic system of temporal classification is established as an alternative to the existing geochronologic and chronostratigraphic classifications, which are not formally abandoned. Long-standing names in midcontinent temporal nomenclature are retained in the new diachronic system, but they are used in noun form to clearly differentiate them from the adjectival form used in the chronostratigraphic and geochronologic classifications, which assume time-parallel boundaries. The hierarchy of event intervals used includes, in order of decreasing rank, episode, subepisode, and phase.

The Wisconsin Episode is divided into two subepisodes in Illinois: the Athens Subepisode, which includes the Alton and Farmdale Phases; and the Michigan Subepisode, which includes 12 phases. The Alton and Farmdale Phases represent intervals of loess deposition (Roxana Silt) and soil formation (Farmdale Geosol), respectively. Eight phases of the Michigan Subepisode (Marengo, Shelby, Putnam, Livingston, Woodstock, Crown Point, Port Huron, and Two Rivers) represent intervals of glacial activity, each of which began with a major advance or readvance of the Lake Michigan Lobe. Four phases of the Michigan Subepisode (Worth, Milwaukee, Mackinaw, and Two Creeks) represent deglacial intervals. The glacial and deglacial phases are represented by glacigenic sequences consisting of the Wedron Group diamicton deposits and the Mason Group sorted-sediment deposits. The Wisconsin Episode was succeeded by the postglacial Hudson Episode.

INTRODUCTION

Although the Lake Michigan Lobe of the Laurentide Ice Sheet invaded only the northeastern quarter of Illinois during the last glacial episode, deposits of that glacial interval blanket most of the state. Beyond the maximum ice-margin position, these deposits consist of material that was carried away from the glacier by meltwater and, in some cases, was redeposited by wind. Eventually, this material came to rest as outwash in meltwater channels, lacustrine sediment in lakes and dammed drainageways, or loess downwind of the meltwater channels. These deposits, together with till and other sediment deposited in contact with glacier ice, are also in the northeastern quarter of the state and beneath Lake Michigan. Because these deposits of the last glacial episode are more than 100 meters thick (328 ft) in places, understanding their characteristics, distribution, and interrelationships is critical when making decisions involving agriculture, engineering and construction, resource extraction, waste disposal, and groundwater availability and quality. The purpose of this report is to revise the stratigraphic framework for the classification and nomenclature of these deposits in Illinois and Lake Michigan.

BACKGROUND

Glacial deposits of the north-central part of the United States have been recognized to represent multiple glacial events for more than a century. In 1878 T. C. Chamberlin, working in the Kettle Moraine region of eastern Wisconsin, provided the first detailed description and analysis of deposits of different ages (White 1973). Later (1894, 1895), Chamberlin introduced the term Wisconsin for the deposits and time of the last glaciation. In the 100 years that followed, deposits of the Wisconsin glaciation were used to further subdivide (Leverett 1899, Leighton 1931) the Wisconsin glacial interval and later to expand (Leighton 1933, Leighton and Willman 1950) its concept. Emphasis in these early studies was on age of deposits and separating deposits of different glacial events, primarily by using buried soils and morphologic relationships. Some deposits were recognized as distinct units because of color (e. g., the pink till of the Bloomington moraine) or texture (e. g., the clay-rich till of the Marseilles moraine). Eventually, a few units were described and named essentially the way lithostratigraphic units are defined today (e. g., the Mahomet sand, Horberg 1950; the Brussels formation, Rubey 1952; the Lemont drift, Bretz 1955). The process of developing a comprehensive stratigraphic framework for deposits of the last glacial episode in Illinois began, however, in 1960 with the work of J. C. Frye and H. B. Willman. At that time, they introduced a formal chronostratigraphic unit, the Wisconsinan Stage, for the materials deposited during the last glacial episode. In the decade that followed, the concept of the Wisconsinan Stage was further refined, and lithostratigraphic units were introduced and described (Frye et al. 1968). The effort to establish a stratigraphic framework for these deposits, as well as those for the entire Pleistocene Series in Illinois, culminated in 1970 when Willman and Frye published *Pleistocene Stratigraphy of Illinois.* They introduced a fourfold classification that included time-stratigraphic (chronostratigraphic), rock-stratigraphic (lithostratigraphic), soil-stratigraphic (pedostratigraphic),and morphostratigraphic (drift) units (fig. 1). Within the Wisconsinan Stage, they formalized 34 lithostratigraphic units, 15 as formations and 20 as members.

The basic stratigraphic framework established by Willman and Frye has been used in Illinois since 1970; however, revision and updating are essential for several reasons. First, many new research projects completed since 1970 have significantly increased our knowledge of the lithology, distribution, and correlation of the deposits of the last glaciation. New lithostratigraphic units (one formation and nine members) have been defined (Willman et al. 1971, Johnson et al. 1971b, Ford 1973, Lineback et al. 1974, Wickham 1979a); others have been revised, abandoned, or reclassified to correct errors in correlation (Berg et al. 1985, Curry and Kempton 1985, Johnson et al. 1985a). In some areas, many new data are available. Although much of this new information is published, it is scattered in many sources (e. g., ISGS publications, scientific journal articles, proceedings volumes, special papers for various societies, and graduate-student theses) and needs to be synthesized. A second reason to modify the 1970 classification system is the growing demand in applied work for detailed geologic maps and cross sections that accurately show the distribution of Quaternary deposits (Hackett 1968). A new classification system is needed; one that is practical for both basic and applied scientific work and at the same time enhances understanding of relationships among the deposits. Finally, the publication of the International Stratigraphic Guide (ISSC) in 1976 and the North American Stratigraphic Code (NACSN) in 1983, as well as other more recent classification systems in the region (e. g., Mickelson et al. 1984, Attig et al. 1988), provides new guidelines for (and/or examples of) lithostratigraphic and temporal classification for the Quaternary.

Willman and Frye (1970) based their stratigraphic framework primarily on till, loess, and soil stratigraphy (fig. 1). The Wisconsinan Stage till units were classified into members of two formations, whereas the loess units were classified into four formations. Buried soils were used to define the lower boundary of the Wisconsinan Stage and to divide the Wisconsinan Stage into substages. Glacial outwash and lacustrine units at the surface were treated as distinct lithostratigraphic units, but those in the subsurface were included as informal facies of till units. Surficial outwash, lacustrine, and eolian sand units of the Wisconsinan Stage were classified as separate formations.

In this revision, the stratigraphic framework for deposits of the Wisconsin glacial episode is established by classifying the glacial (till and ice-marginal diamicton) and the pro-

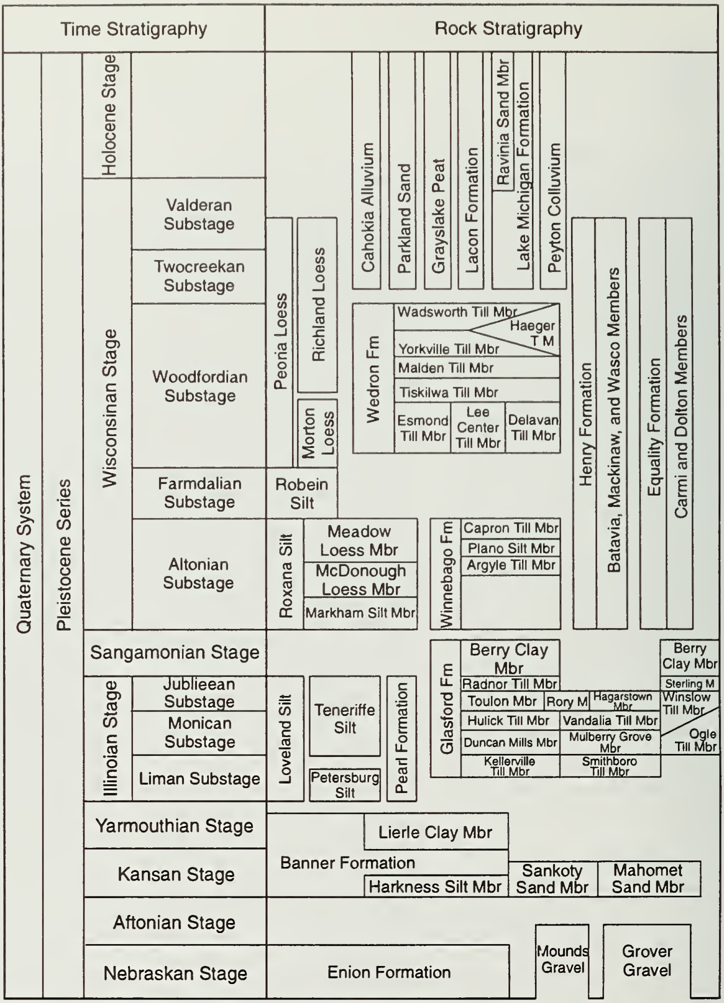


Figure 1 Stratigraphic classification of Pleistocene deposits in Illinois (from Willman and Frye 1970).

glacial (loess, outwash, lacustrine, eolian sand) units into two groups that intertongue with each other. Although the fundamental or basic unit in lithostratigraphy is the formation (NACSN 1983), Quaternary geologists in Illinois (at least since 1970) have generally described, mapped, and interpreted geology on the basis of till units at the member rank. To reinstate the formation as the more fundamental lithostratigraphic unit, we raised the rank of the Wedron Formation (fig. 1) in Illinois Quaternary geology to the Wedron Group, and established four formations within it: the Tiskilwa, Lemont, Wadsworth, and Kewaunee. These formations constitute the main till units of the last glacial episode in Illinois and the Lake Michigan basin.

In Willman and Frye's 1970 classification, subsurface sorted-sediment units, except for loess units, were treated as informal facies of till units. This practice has tended to deemphasize their importance; yet, for most

Soil Stratigraphy	Morphostratigraphy		
Modern Soil			
	Lake Border Drifts		
	Zion City D		
	Highland Park D		
	Blodgett D		
	Deerfield D		
	Park Ridge D		
	Tinley D		
	Valparaiso Drifts		
	Palatine D		
	Clarendon D		
	Fox Lake D		
	Roselle D		
	Westmont D		
	Keeneyville D		
	Cary D		
Jules Soil	Wheaton D		Iroquois D
	West Chicago D		
	Manhattan D		
	Wilton Center D		
	Rockdale D		
	St. Anne D		
	Minooka D		
Farmdale Soil	Marseilles Drifts		
	Ransom D	Barlina D	Gilman D
	Norway D	Huntley D	
	Cullom D	St. Charles D	
	Farm Ridge D	Gilberts D	Chatsworth D
Pleasant Grove Soil	Mendota D	Elburn D	
	Arlington D	Strawn D	Ellis D
Chapin Soil	Shabbona D	Minonk D	Paxton D
	Paw Paw D	Mt. Palatine D	
	La Moille D	Varna D	
Sangamon Soil	Theiss D	El Paso D	
	Van Orin D	Fletchers D	
	Dover D	Eureka D	Illiana Drifts
	Arispie D	Normal D	Gifford D
	Bloomington Drifts		Newtown D
	Marengo D	Metamora D	Urbana D
	Providence D	Washington D	Rantoul D
Pike Soil	Buda D	Kings Mill D	Champaign D
	Sheffield D		Ridge Farm D
	Shaws D		Hildreth D
Yarmouth Soil			West Ridge D
			Pesotum D
		Shirley D	Arcola D
		Le Roy D	Cerro Gordo D
		Heyworth D	Turpin D
			Shelbyville Drifts
Afton Soil	Harrisville D		Paris D
	Temperance Hill D		Nevins D
	Atkinson D		Westfield D
	Alluvial terraces are informally named in local areas		

practical applications as well as for understanding glacial history, the distribution and correlation of these subsurface sorted-sediment units are critical. Our revision addresses this problem by choosing the option in the North American Stratigraphic Code (NACSN 1983, p. 856, Art. 23b) to formally recognize intertonguing relationships among lithostratigraphic units. We classify, in a separate group, the proglacial sorted-sediment units of the last glacial episode, which intertongue with each other and with the formations of the Wedron Group. This new Mason Group contains four formations: the Roxana and Peoria Silts and the Henry and Equality Formations. Figure 2 shows the relationships between the Wedron and Mason Groups and among the formations within the Mason Group; the distribution of the Wedron and Mason Groups in Illinois is shown on plate 1.

TERMINOLOGY

Largely in response to recommendations proposed in the International Stratigraphic Guide (ISSC 1976), the North American Commission on Stra-

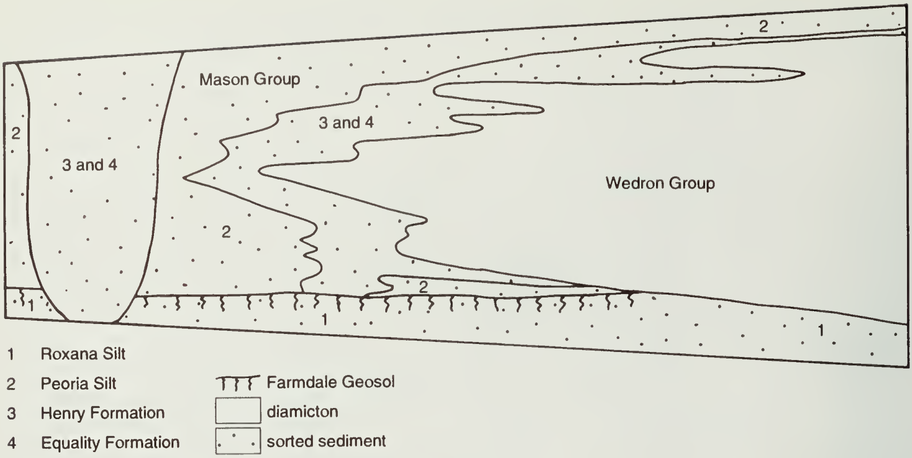


Figure 2 Diagram shows the intertonguing relationships among the Mason Group sorted-sediment units (Roxana and Peoria Silts and Henry and Equality Formations) and between the Mason Group sorted-sediment units and the Wedron Group diamicton units. The Wedron Group diamicton units (Tiskilwa, Lemont, Wadsworth, and Kewaunee Formations) are not differentiated in the diagram.

tigraphic Nomenclature changed the names of several unit categories in the 1983 Code. The category name for a stratigraphic unit based on lithology was changed from a rock-stratigraphic unit in the 1961 Code (ACSN) to a lithostratigraphic unit in the 1983 Code. Similarly, the category name for a time-stratigraphic unit changed to a chronostratigraphic unit, that for a geologic time unit to a geochronologic unit, and that for a soil-stratigraphic unit to a pedostratigraphic unit (called geosol). In this report, we follow the terminology recommended in the 1983 Code.

The terminology for glacial deposits has also evolved since the previous classification (Willman and Frye) was published in 1970. Studies of modern glacial environments have shown material similar to that commonly referred to as till is polygenetic. Till can be deposited subglacially as debris melts out from the base of the glacier, or as a water-saturated substrate gains shear strength and finally ceases to move. Till or till-like sediment can also be deposited (1) in the ice-marginal environment when debris melts out and is passively let down or actively reworked by mass wasting processes, (2) in subaqueous environments beneath the glacier or beyond the ice margin when debris released from melting ice falls through water or travels as a debris flow within water, and (3) outside the glacial environment as a result of mass wasting processes along slopes.

Adding to the confusion in terminology is the fact that the term till has commonly been used as a genetic term for material interpreted to have been deposited by a glacier and as a lithic term for material, generally unstratified, that is non- to poorly sorted and contains a wide range of particle sizes. Because this dual usage leads to misunderstanding of glacial history, we reserve the term till for material deposited directly from glacier ice or from a deforming substrate beneath glacier ice (i. e., till is used in a genetic sense). We use the term diamicton (Flint et al. 1960) to refer to sediment, generally unstratified, that is non- to poorly sorted and contains a wide range of particle sizes (i. e., diamicton is used in a descriptive sense). The term diamicton is used to indicate only a large range of particle sizes and does not specify the relative abundance of any or all clast sizes. Non- to poorly sorted sediment mixtures that contain at least 1% gravel are described as diamicton. For sediment mixtures containing less than 1% gravel, the empirically developed limits used by the U.S. Department of Agriculture are applied to separate the clay (50% clay), silt (80% silt), and sand (85% sand) categories. Sediment mixtures containing 50% gravel or more are in the gravel category, as recommended by Willman and Payne (1942, p. 343).

Most till in Illinois is diamicton, and it consists of gravel clasts and a matrix composed of sand, silt, and clay. Not all diamicton in Illinois is till, however. Some diamicton was deposited by subaerial and subaqueous debris flows within or outside the glacial environment. Other diamicton was deposited in lakes by settling of sediment through water. Determining diamicton genesis is important for understanding the sediment record, interpreting glacial history, and predicting the probable sediment sequence in areas for which site-specific data are unavailable.

In this report, we use the term glacigenic to describe deposits, environments, processes, and landforms directly related to or induced by glaciation. Some common glacigenic deposits include till, loess, and fluvial, lacustrine, and debris-flow deposits. Glacigenic environments include subglacial, englacial, supraglacial, ice-marginal, and proglacial environments. The succession of sediment deposited as a glacier advances into an area and subsequently melts away is referred to as a glacigenic sequence. Some glacigenic sequences are complete in that they record the entire succession of glacigenic environments that migrate across a site during an ice-margin fluctuation. For example, a complete sequence would include from the base upward

- proglacial sediment (loess, lacustrine sediment, outwash) deposited beyond the advancing ice margin;
- ice-marginal sediment (lacustrine sediment, outwash, debris-flow sediment) deposited at the ice margin;
- subglacial sediment (till, fluvial, lacustrine, and debris-flow sediment) deposited beneath the glacier;
- ice-marginal sediment deposited as the glacier was downwasting and backwasting;
- proglacial sediment deposited beyond the ice margin as the glacier was wasting back.

Because glacigenic environments are complex and variable, glacigenic sequences are varied and often incomplete. The topography of the area into which the glacier advances affects the type of depositional environments and sediment sequences. For example, if the glacier advances into an area where the regional slope is toward the glacier, a proglacial lake would form where the drainage is blocked. The resulting sediment record would be quite different from that of a glacier advancing into an area where the regional slope is away from the glacier and meltwater streams carry much of the sediment away from the ice margin. Glacigenic sequences also differ because of variation in the amount of erosion that occurs between depositional events. Where erosion is the dominant process during a glacial episode, the glacigenic sequence is unlikely to contain a complete sediment record of the glacial events that occur.

Although Willman and Frye (1970) proposed formal morphostratigraphic (drift) units to subdivide the deposits of the last glaciation in northeastern Illinois, at present we do not see a need to formally retain such interpretive units. The formal drift units of Willman and Frye (e. g., the Tinley Drift or Lake Border Drifts) were defined as "deposits of glacial till and outwash associated with a moraine and traceable from it into the groundmoraine, outwash apron, and beneath younger drifts" (Willman and Frye 1970, p. 44). In this report, we maintain general informal usage of the term drift to refer to all glacigenic sediment. In general usage the term is not capitalized, as in the "Lemont drift," named for a distinct drift sheet in the Chicago area (Bretz 1955), or the "Tinley drift," which refers to the glacial sediment associated with the Tinley Moraine.

In our classification, units are described on the basis of their physical properties (e. g., color, grain size, lithology, bedding). Most of the characteristics are reported in qualitative rather than quantitative terms. The matrix grain size of till units (i. e., diamicton units interpreted as till) is described using the U.S. Department of Agriculture terminology for the less than 2 mm fraction. In the Lake Michigan Lobe area, fine grained till commonly has a matrix grain size of clay, silty clay, or silty clay loam; medium grained till has a matrix grain size of clay loam, silt loam, or loam; and coarse grained till has a matrix grain size of sandy loam. Many analytical data such as matrix grain size, less than 74 μm calcite and dolomite content, clay-mineral composition, and engineering properties have been determined to characterize lithostratigraphic units in important reference sections and cores of the Wedron and Mason Groups (see appendix A).

EVOLUTION OF PRINCIPLES OF LITHOSTRATIGRAPHIC CLASSIFICATION IN ILLINOIS

WILLMAN AND FRYE'S CLASSIFICATION

Willman and Frye (1970) subdivided the Quaternary deposits of Illinois primarily on the basis of several factors:

• Lithogenesis. Sediment types that resulted from distinct depositional processes were classified in different formations or members (fig. 1). Some examples include the Henry Formation (glaciofluvial sediment), the Peoria Loess (glacioeolian sediment), the Tiskilwa Till Member (primarily subglacial till), the Cahokia Alluvium (fluvial sediment).

• Lithology and stratigraphic position. Sediment types produced by similar processes were classified in different lithostratigraphic units if they were lithologically distinct and occupied a consistent stratigraphic position. For example, the coarse grained diamicton of the Haeger till and the underlying fine grained diamicton of the Yorkville till were classified as separate till members of the Wedron Formation.

• Stratigraphic relationships to buried soils. Buried soils were used to separate lithogenetically similar sediments (e. g., tills or loesses) into different lithostratigraphic units. For example, the Sangamon Soil was used to separate the Wedron Formation from the Glasford Formation, whereas the Farmdale Soil was used to separate the Peoria Loess from the Roxana Silt.

• Whether deposits occurred at the surface or interfingered with till formations. The glaciofluvial, glaciolacustrine, and glacioeolian deposits were recognized as formations only where they occurred at the surface, directly beneath the surficial loess, or in the subsurface between till formations. Where these sorted-sediment deposits interfingered with diamicton of a till formation, they were included in the diamicton (till) formation using arbitrary vertical boundaries (fig. 3).

In developing a classification framework for Pleistocene deposits of Illinois, Willman and Frye (1970, p. 40–41) also considered the alternatives of (1) classifying all of the Pleistocene deposits of Illinois in one formation (or two formations by separating the loess and glacial deposits), and (2) recognizing most of the formal members as formations in their own right. They rejected both alternatives, however. They argued the former would result in formational units too large to be useful and the latter would result in too many formational units. Although they found the classification framework they proposed to be the most practical at the time, they acknowledged that it was intended to be modified and expanded as the need developed.

Willman and Frye (1970) subdivided the Wedron Formation into members in the Peoria, Princeton, Harvard, and Joliet Sublobe areas; they left it undifferentiated in the Decatur Sublobe area (fig. 4). The members were differentiated primarily on the basis of diamicton lithology, stratigraphic position, and location with respect to different sublobe boundaries. Till member boundaries were drawn to coincide with the outer boundaries of certain end moraines.

Willman and Frye's classification was built upon and modified as a result of more detailed studies in the 1970s and 1980s. Formal members were defined in the Decatur Sublobe area (Johnson et al. 1971b, Ford 1973, Wickham 1979a). In the Dixon and Green River Sublobe areas, the Sangamon Geosol, which occurs beneath the deposits of the Wisconsinan Stage, was found to be developed in the Lee Center and Esmond Till Members (fig. 4) This relationship indicates these till members occur stratigraphically below the Wedron Formation (Berg et al. 1985; fig. 1).

INFLUENCE OF DETAILED STUDIES AND USE OF ANALYTICAL DATA

When the formal classification was established in 1970, analytical data on texture and composition of deposits were being used to characterize the lithostratigraphic units and to assist in correlation of the units. Such practice was extensive in Illinois, with particular emphasis on matrix grain size of diamicton, clay-mineral composition of the less than 2 µm fraction, and carbonate-mineral composition of the less than 74 µm fraction (e. g., Kempton 1963, Willman et al. 1963, Johnson 1964, Kempton and Hackett 1968b, Frye et al. 1969, Jacobs and Lineback 1969, Johnson et al. 1971b, Lineback 1979, Killey 1982, Hansel 1983, Glass and Killey 1987, Wickham et al. 1988). Laboratory data were also used to subdivide lithostratigraphic units into mineral zones (e. g., Frye et al. 1962, McKay 1979a, b, Killey 1982) or other informal units (e. g., Kempton et al. 1971, Lineback 1979, Graese et al. 1988, Wickham et al. 1988) and, although rarely, to define formal units (e. g., some till members of the Winnebago Formation; Berg et al. 1985). In some cases, the informal units delineated on the basis of laboratory data were recognized as major lithostratigraphic units and were attributed to result from major ice-margin readvances (e. g., Lineback et al. 1983). In other cases, they were interpreted as lateral or vertical grain-size or compositional facies of lithostratigraphic units (e. g., Willman et al. 1963, Wickham and Johnson 1981, Glass and Killey 1987, Graese et al. 1988, Wickham et al. 1988). Sedimentological studies confirm that although some changes in diamicton grain size and composition within the glacial succession correspond to breaks between deposits attributed to different glacial events (ice-margin advances and retreats), other changes occur within deposits attributed to a single glacial event (Johnson and Hansel 1990). Even though analytical data were not used consistently with respect to lithostratigraphic classification or interpretation, they proved helpful in differentiating and correlating units on local and regional scales, particularly in the subsurface, and in characterizing variability within units. Sources and types of available analytical data for the lithostratigraphic units of the Wedron

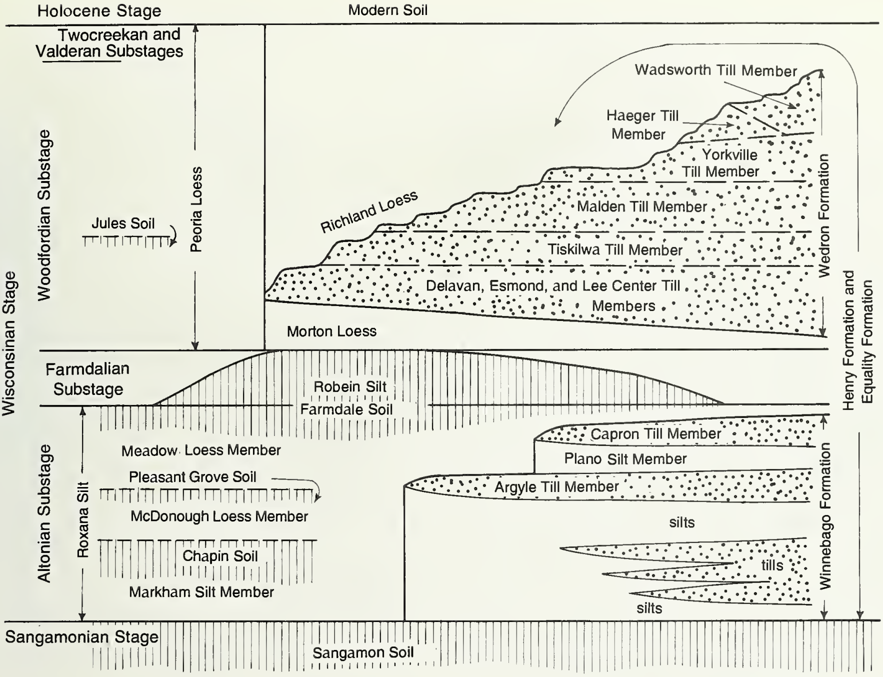


Figure 3 Diagram shows Willman and Frye's (1970) use of arbitrary vertical boundaries to avoid intertonguing of till members with sorted-sediment units in classification of the deposits of the Wisconsinan Stage.

and Mason Groups are reported in appendix A.

In contrast to Willman and Frye's (1970; fig. 4) mapping, Lineback (1979), in differentiating till members on the state map of Quaternary deposits (fig. 5), placed relatively more emphasis on the lithology (particularly matrix grain size) of till units and less on the relationship of till units to end moraines. As a result, several units were extended beyond the geomorphic-based unit boundaries (end moraines) initially suggested by Willman and Frye (e. g., in the southwestward-protruding areas of the Snider and Yorkville Till Members in fig. 5). Overall, the resultant map patterns may show lithologic distinctions more accurately than those of the Willman and Frye (1970) map (fig. 4b); however, from the standpoint of interpretation of glacial history, the map less clearly reflects ice-margin fluctuations in some areas. This is especially true in areas where different till units mapped along an end moraine may reflect a facies change during a single event rather than an overlap of an older till unit by till from a younger event.

Stratigraphic studies in the Decatur, Peoria, Princeton, and Harvard Sublobe areas (fig. 4a) suggest that the stratigraphic and lithologic sequences of till units in these different areas are generally similar (Kempton et al. 1971, Johnson et al. 1971b, McKay 1975, Wickham 1979a, Moore 1981, Johnson et al. 1986). Partially on the basis of these studies, Johnson (1976) observed that most of the existing till members of the Wedron Formation could be placed into five lithologic groupings or families of till. Johnson et al. (1985b) further evaluated the existing till members in northern Illinois and suggested raising the rank of some of the members to formation status. Clearly, some of the present members of the Wedron Formation meet the criteria for formation status set forth in the North American Stratigraphic Code (NACSN 1983) in that they are the fundamental units used in describing and interpreting the geology of the area.

OBJECTIVES AND PRINCIPLES USED IN RECLASSIFICATION

The objectives of this reclassification of the deposits of the Wisconsin glacial episode are to (1) change the rank of some lithostratigraphic units in Willman and Frye's (1970) classification so that unit ranks are more consistent with the guidelines proposed in the 1983 Code; (2) abandon certain units for reasons of synonymy; (3) better reflect the relationships among the lithostratigraphic units; (4) recommend practices with respect to the use of analytical data and the mapping of formal and informal units; and (5) change units described on lithogenetic criteria to units described on lithostratigraphic criteria and replace lithogenetic terms (e. g., loess, till) in the formal names of lithostratigraphic units with nongenetic lithic or rank terms (e. g.,

Figure 4a Lobe and sublobe boundaries in Illinois during the last glaciation (from Willman and Frye 1970). Locations of the ancient Mississippi and Iowa Rivers added.

Figure 4b Areal distribution of predominant Quaternary formations and members in Illinois (from Willman and Frye 1970).

silt, member, formation). Lithogenetic terms will continue to be used as informal names for units that have genesis established (e. g., Haeger till).

In this revision, we modify the basic system of classification established by Willman and Frye (1970) (fig.1) to include the following principles (fig. 6):

(1) For units consisting predominantly of diamicton, formations are composed of lithologically distinct bodies of diamicton. These formations are distinguishable on the basis of field criteria (e. g., diamicton color, grain size, clast lithology), have regional significance, and in most areas have clear boundary relationships with adjacent units. In figure 6, for example, formations X, Y, and Z are composed of lithologically distinct bodies of diamicton within a group.

(2) Silt, silt and clay, or sand and gravel units that occur above, beyond, or interfingered with the diamicton formations are defined as formations within a group consisting predominantly of sorted sediment (e. g., formation A in fig. 6 is depicted as sand and gravel). Buried sorted-sediment units could also be defined at formation rank, although none of that rank is shown in figure 6 or defined in this report.

(3) Members are recognized within formations where lithologic distinctions and stratigraphic relationships warrant such recognition. Lithologic distinctions result from regional and/or vertical changes in the diamicton's lithologic character (e. g., color, grain size, clast lithology) or from changes in sediment type (e. g., diamicton, silt, sand and gravel). Units X1, X2, Z1, and Z2 are formal members of formations X and Z, respectively. In areas where boundary conditions are indistinct or not well established (e. g., between member X2 and formation X), arbitrary mapping boundaries are suggested pending further investigation. This same practice is also used in cases where formation boundaries are indistinct (none shown in fig. 6, but formations Y and

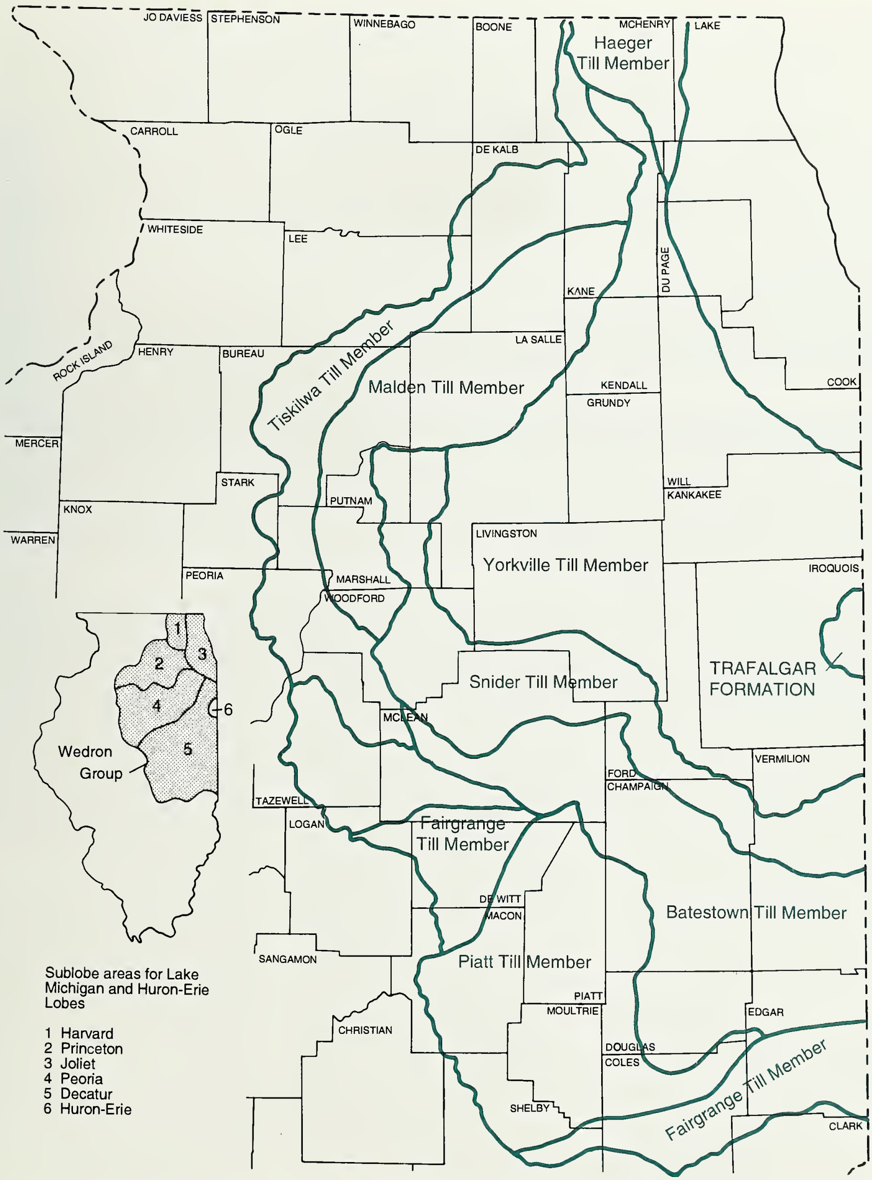


Figure 5 Areal distribution of the Wedron Formation till members and the Trafalgar Formation (after Lineback 1979).

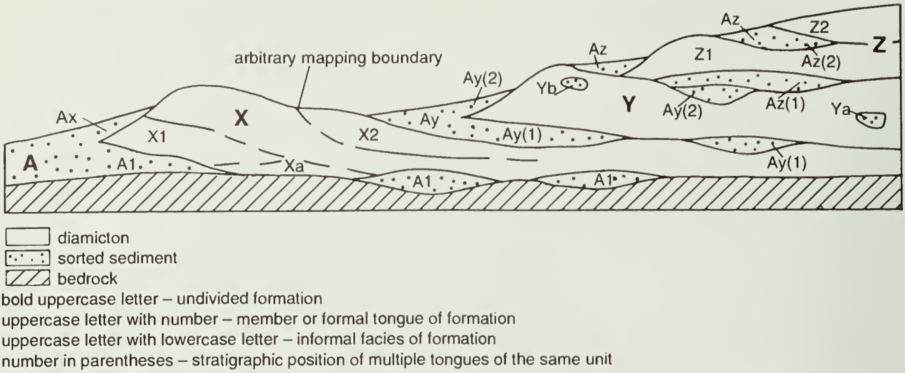


Figure 6 Diagram shows boundaries and classification of formal units (groups, formations, members) and tongues and informal facies within two intertonguing groups consisting predominantly of diamicton and sorted sediment. Formation A is a lithostratigraphic unit of a sorted-sediment group that interfingers with formations X, Y, and Z, diamicton units of a separate group. Formation A contains A1, a tongue of formation A that extends beneath formation X, and informal facies Ax, Ay, Az, sorted-sediment units interpreted to relate to formations X, Y, and Z, respectively. Where two or more tongues of the same facies occur in stratigraphic sequence, numerals in parentheses are added to designate the different tongues, for example Ay(1) and Ay(2). Formation X is partially subdivided; two members, X1 and X2, and one informal unit, facies Xa, are recognized. Formation Y is not subdivided into members, but two sorted-sediment facies, Ya and Yb, are recognized. Formation Z is subdivided into members Z1 and Z2.

Z could be difficult to distinguish locally, for example).

(4) Units that exhibit regional and local changes in sediment type (e. g., diamicton, sand, silt, clay) or diamicton lithology are treated informally until further studies indicate that formal definition is warranted. Such informal units include depositional facies, textural facies, color facies, and mineral zones. Some have been given names (e. g., the Dwight mineralogical zone, Killey 1982; Oakland facies, this report). An example in figure 6 is unit Xa, which represents diamicton that is lithologically distinct from formation X but is relatively thin and/or discontinuous. It is treated as a textural and/or mineralogical facies of formation X.

(5) Diamicton and sorted sediment commonly intertongue, particularly near the outer extent of diamicton units as illustrated in figure 6. Intertonguing deposits can be classified in different ways (NACSN 1983). Willman and Frye (1970) used arbitrary vertical boundaries to include intertonguing sorted sediment within diamicton units; correlative sorted sediment extending beyond the diamicton was classified in a different formation, and hence it had a different name (fig. 3). Because the relationships among diamicton and sorted-sediment units can be better understood when the units are depicted more realistically as interfingering, we have chosen to formally recognize intertonguing lithostratigraphic units.

Tongues and lenses of a formation can be formally recognized on the basis of stratigraphic position. For example, in figure 6, tongues and lenses of unit A below formation X can be recognized as a formal tongue of formation A with a distinct name (A1). Similar units intertonguing between formations X and Y and between members Z1 and Z2 may be thinner and less well known; these units, which may not have regional significance, could be recognized as informal tongues and lenses of formation A. If such lenses and tongues occur at different stratigraphic positions within an area, as in this example, they would be distinguished by numbering or some other means. The lens of sorted sediment between formations Y and Z is similar to unit A lithologically and could also be considered an informal lens of unit A, particularly if field relationships suggest it was once continuous with unit A beyond the boundary of Z1.

(6) Both surface and subsurface units of the sorted-sediment group are genetically related to diamicton units of the diamicton group. Where these genetic relationships are clear, the sorted-sediment units can be tied informally to the glacigenic sequences of which they are a part, if such genetic links are helpful in explaining and predicting relationships among materials. For example, in figure 6, unit Ay is an informal unit of formation A and can be recognized as such on maps and cross sections. It could be sorted sediment that on the basis of lithology and/or sedimentology and stratigraphic relationships is interpreted to be part of the same glacigenic sequence as formation Y.

(7) Where tongues and lenses of a stratigraphic unit are not formally named, they can either be numbered from older to younger or informally named so that the unmodified name of the stratigraphic unit does not repeat itself in a vertical succession. Thus, in the example in figure 6, the lower tongue-lens combinations of unit A would have a formal name (A1); the overlying tongue-lens combinations are informal units designated by informal names [i. e., Ay(1), Ay(2), Az(1), Az(2) from the base upward]. Lenses of sorted sediment that are not traced to or correlated with formation A are classified informally as sorted-sediment lenses within a diamicton formation (e. g., lenses Ya and Yb are part of formation Y).

(8) Lithostratigraphic units are defined on the basis of lithology; nevertheless, as indicated in the North American Stratigraphic Code (NACSN 1983, Article 23c, p. 858), where feasible, boundaries between lithostratigraphic units should be placed where lithic changes correspond with those of genetic units. Such a boundary is not shown in figure 6. However, if such a sand and gravel body associated with deposits of an earlier glaciation than those shown in figure 6 were to underlie formation A and the unit were to have a lithology distinct from that of formation A, then a boundary between the two sand and gravel lithostratigraphic units would be drawn where the lithic change occurs. Such practice is desirable because it aids in understanding the glacial history of an area. If no lithic change in sand and gravel of different events can be discerned, all the sand and gravel would be classified in formation A. Thus, formation A in figure 6 may contain sorted sediment associated with glacigenic sequences older than those represented by the diamicton formations shown.

In the past two decades, understanding of the glacial and postglacial sediment record in Illinois has resulted from studies conducted using different approaches. In some cases, detailed sedimentological studies of the deposits led to a better understanding of their lithofacies, environments of deposition, and vertical and lateral variability. In the extensive areas where surface exposures are shallow or lacking, subsurface cores, boring logs, and water-well records provided critical information to fill data gaps. Many questions remain about relationships among materials in the sediment record, particularly in areas where data are sparse or the geology is complex. We have revised the stratigraphic framework so it is flexible enough to be used with surface and subsurface data and, at the same time, can be easily modified or further developed as new data and increased understanding emerge. In this revision we simplified nomenclature by eliminating multiple names for the same lithostratigraphic unit. Future studies will no doubt reveal new needs for nomenclatural additions and revisions as understanding of the sediment record increases.

LITHOSTRATIGRAPHIC FRAMEWORK

The sediment record of the Wisconsin Episode of glaciation consists of a complex succession of deposits that record migrating proglacial and glacial environments. These deposits are classified in two intertonguing groups. The till and ice-marginal deposits, mainly diamicton, are collectively classified as the Wedron Group, whereas the proglacial sorted-sediment deposits, mainly loess, eolian sand, lake sediment, and outwash, are collectively classified as the Mason Group.

WEDRON GROUP

The four formations of the Wedron Group (fig. 7) constitute lithostratigraphic units that have regional significance within the Lake Michigan Lobe area (fig. 8). Each formation consists predominantly of diamicton that has a characteristic lithology and/or unique stratigraphic position. The lower formations pinch out beneath the overlying ones to the north and east in the central part of the lobe area. Generally no more than two formations are superposed, except in the lateral parts of the lobe area where, in some places, three have been found in stratigraphic position (e. g., extreme northeastern Illinois and southeastern Wisconsin).

The basal unit of the Wedron Group is the Tiskilwa Formation. Diamicton of the Tiskilwa Formation generally has a red hue (red brown to red gray) and a matrix of medium grain size (25%–40% clay). Two members contain diamicton that is grayer and coarser than type-Tiskilwa till. They are recognized as the lower Delavan Member and the upper Piatt Member. The Tiskilwa Formation crops out in a crescent-shaped pattern at the southwest end of the Lake Michigan Lobe area (fig. 8). It forms a significant subsurface unit wedging out beneath the Lemont Formation.

Diamicton of the Lemont Formation is more heterogeneous than that of the other Wedron Group formations. The characterizing grain-size fraction of the matrix is silt, which makes up 40% to slightly more than 50% of the diamicton. In the type area southwest of Chicago, Lemont diamicton has a light gray silt loam to sandy loam matrix; it contains abundant coarse gravel, more than 75% of which is dolomite. Northwest of the type area, Lemont diamicton is in facies relationship with the sandy loam diamicton of the Haeger Member, whereas west and south of the type area, it is in facies relationship with silty clay diamicton of the Yorkville Member, or possibly, with the silt loam diamicton of the Batestown Member. Yorkville diamicton constitutes a dark gray, silty clay wedge of the Lemont Formation, and it pinches out beneath or is in facies relationship with buried silt loam diamicton of undivided Lemont Formation in its type area southwest of Chicago. In the type area, undivided Lemont Formation constitutes a distinctly silty subsurface unit that generally overlies bedrock. Correlative diamicton is present in southeastern Wisconsin and crops out along the lake bluffs at Milwaukee (Mickelson et al. 1984).

The Wadsworth Formation, a unit containing dark gray, silty clay diamicton, overlies the Lemont Formation. The Wadsworth Formation is present at the surface in the moraines that encircle the southern Lake Michigan basin. It underlies sediment beneath Lake Michigan and part of the lake plain in the metropolitan Chicago area (fig. 8). Wadsworth diamicton generally contains less than 15% sand in its matrix; often more than 90% of the matrix is silt and clay. Lithologically, diamicton of the Wadsworth Formation is like that of the Yorkville Member of the Lemont Formation. In the area south and west of Chicago, the Wadsworth Formation overlaps the Yorkville Member, and the boundary between the two units is not always distinct. However, because Wadsworth diamicton occurs at a stratigraphic position above the upper, coarser grained Lemont diamicton in that area (Johnson and Hansel 1989), the two units are classified in separate formations. The Wadsworth Formation pinches out beneath the Kewaunee Formation, which crops out along the lake basin north of Milwaukee, Wisconsin, and Muskegan, Michigan, and beneath sediment in the northern three-quarters of Lake Michigan.

Diamicton of the Kewaunee Formation is reddish. It generally contains 45% to 50% silt in the matrix, which ranges from silty clay to silt loam. Mickelson et al. (1984) defined the Kewaunee Formation and subdivided it into members on the basis of diamicton lithology and stratigraphic position. They found that the matrix grain size of the Kewaunee diamicton is progressively coarser for each member. Diamicton of the lowermost member has the finest grain size and that of the uppermost member is the coarsest. In this report, we classify the red diamicton units beneath Lake Michigan and defined by Lineback et al. (1974) as members of the Kewaunee Formation. They include the Shorewood, Manitowoc, and Two Rivers Members (fig. 7).

MASON GROUP

Intertonguing with the Wedron Group diamicton formations are the Mason Group sorted-sediment formations, the Roxana and Peoria Silts and Henry and Equality Formations (figs. 2, 9). They are distinguished predominantly on the basis of grain size and bedding characteristics.

The basal formation of the Mason Group is the Roxana Silt (fig. 2), a unit that generally lacks bedding structures, except for color zonation. It is red brown to red gray and appears massive in exposures. The Roxana Silt, which commonly has the Farmdale Geosol developed in its upper part, occurs above the Sangamon Geosol, which is developed in units of the Illinois or pre-Illinois episodes. Although a glacial sediment source for the Roxana Silt is not definitely known, the silt is dominantly loessal and clearly valley-related. It has a distribution similar to that of the Peoria Silt along the ancient Mississippi Valley in central Illinois (McKay 1979b, Johnson and Follmer 1989). Tongues of the Henry and Equality Formations may interfinger with the Roxana Silt, but such relationships are not known

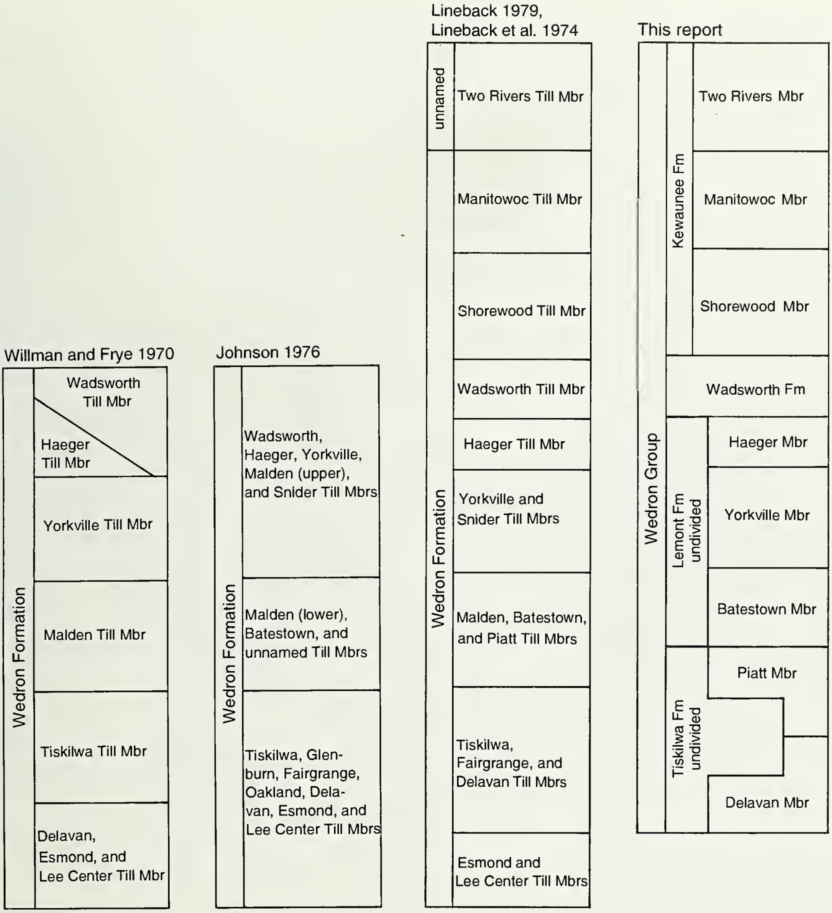


Figure 7 History of lithostratigraphic classification of the Wedron Group deposits.

to be common. One new member of the Roxana Silt is the Robein Member, which was formerly classified as a formation by Willman and Frye (1970). The Robein Member is distinguished from the rest of the Roxana Silt by the presence of stratification; it is characteristically brown to black and rich in organic matter. The Markham, McDonough, and Meadow Members of Willman and Frye (1970) are retained.

Unlike the Roxana Silt, the other four formations of the Mason Group intertongue with deposits of the Wedron Group and/or with each other (fig. 2). They record closely associated proglacial sedimentary environments that migrated as the ice margin fluctuated during the last glacial episode.

The Peoria Silt consists of yellow tan to gray silt that generally lacks bedding structures and appears massive in exposures. The Morton and Richland Loesses, formerly classified by Willman and Frye (1970) as formations separated from the Peoria Loess by arbitrary vertical boundaries along the outer limit of the Wedron Formation, are recognized in this report as lower and upper tongues, respectively, of the Peoria Silt (fig. 9a). The lower tongue is given a formal name, the Morton Tongue, whereas the upper tongue is treated informally and the name Peoria Silt is recommended for the unit beyond and above the Wedron Group.

As originally defined (Willman and Frye 1970), the Henry and Equality Formations were essentially lithogenetic units. The Henry Formation was defined as glacial outwash that is dominantly sand and gravel. The Equality Formation was defined as glacial lake sediment, generally well bedded, that ranges in grain size from clay and silt deposited in relatively deep-water environments (Carmi Member) to sand and gravel deposited in near-shore environments (Dolton Member). In this report, the descriptions of these two formations are changed to remove the genetic connotations. The Henry Formation consists predominantly of bedded sand and gravel, and the Equality Formation predominantly of bedded silt and clay. In places the Henry and Equality Formations interfinger. As redefined, sand and gravel units formerly classified as the Dolton Member of the Equality Formation are now part of the Henry Formation, and they can be designated informally as a near-shore lacustrine facies. Therefore, the Dolton Member of the Equality Formation is abandoned as a formal unit, and for reasons of synonymy with the formation, the Carmi Member is also abandoned. These revisions open the possibility for subdividing the Equality Formation on the basis of lithostratigraphy.

The Henry Formation was subdivided into members by Willman and Frye (1970) predominantly on the basis of morphogenetic units that had fairly distinct lithologies. For example, the Wasco Member was defined as ice-contact sand and gravel deposits occurring mostly in kames, eskers, and deltas; the deposits are characterized by lateral and vertical variation in grain size, sorting, bedding, and structure. By contrast, the Mackinaw Member was defined as outwash deposited in valleys; it is more uniform in texture than other Henry Formation members, and it consists predominantly of sandy gravel or pebbly sand. The Batavia Member was differentiated as an upland outwash unit deposited along the fronts of moraines; the sand and gravel of this unit is characterized by vertical and lateral variation in grain size. Because in this classification we define lithostratigraphic units on the basis of their lithic characteristics and stratigraphic position, we recommend the morphogenetic-based units of the Henry Formation defined by Willman and Frye (1970) be treated informally. They do have useful applications in understanding glacial history and in mapping glacial deposits.

The Peddicord Formation of Willman et al. (1971) is not retained at formation rank. Instead, the unit is recognized as a formal tongue of the Equality Formation (fig. 9c). The Peddicord Tongue occurs, generally in valley fills, beneath the Tiskilwa For-

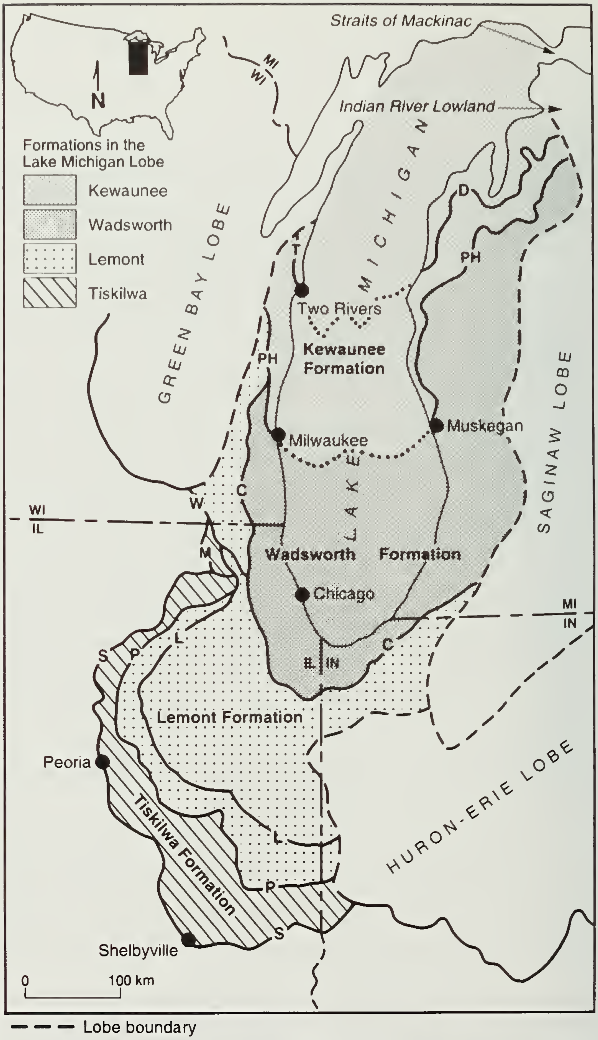


Figure 8 Surface distribution of the Tiskilwa, Lemont, Wadsworth, and Kewaunee Formations (and equivalent units) of the Wedron Group. Also shown are the maximum ice-margin positions during glacial phases in the Lake Michigan Lobe: Marengo (M), Shelby (S), Putnam (P), Livingston (L), Woodstock (W), Crown Point (C), Port Huron (PH), and Two Rivers (T) (modified from Hansel and Johnson 1992; boundaries in Lake Michigan after Foster and Colman 1992).

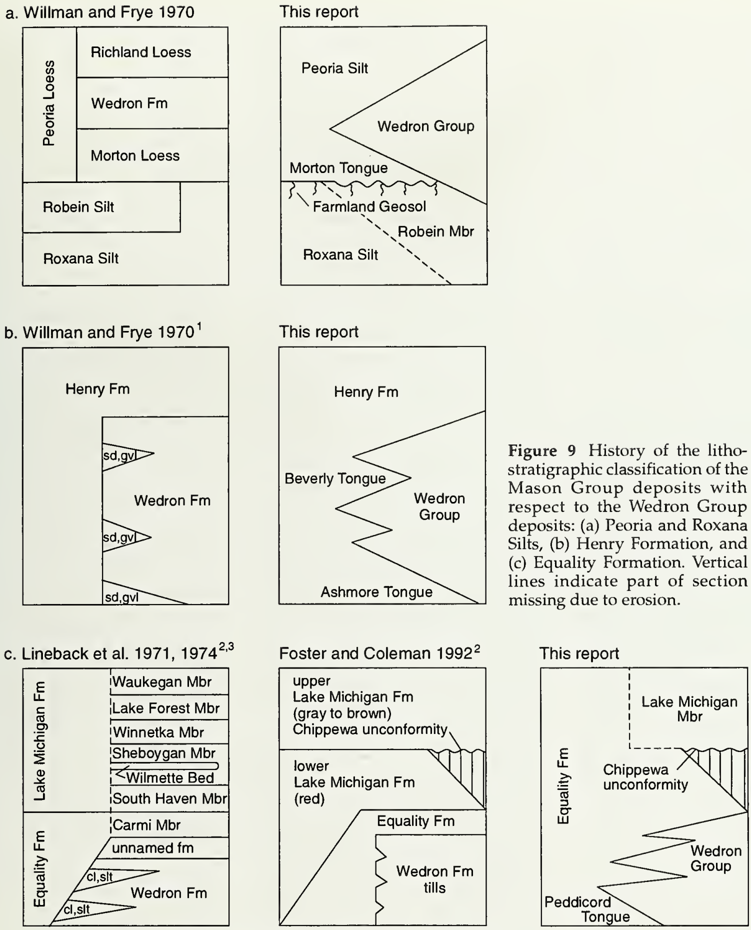


Figure 9 History of the lithostratigraphic classification of the Mason Group deposits with respect to the Wedron Group deposits: (a) Peoria and Roxana Silts, (b) Henry Formation, and (c) Equality Formation. Vertical lines indicate part of section missing due to erosion.

[1]Mackinaw, Batavia, and Wasco Members of Henry Formation not shown.
[2]In Lake Michigan.
[3]Ravinia Sand Member of Lake Michigan Formation and Dolton Member of Equality Formation not shown.

mation of the Wedron Group. At the same stratigraphic position, a formal tongue of the Henry Formation, the Ashmore Tongue (name from Ford 1973), is also recognized (fig. 9b).

The Lake Michigan Formation was defined by Willman and Frye (1970) to consist of the surficial lacustrine deposits and beach sediment (Ravinia Sand Member) of modern lakes. On the basis of color, grain size, mineralogy, water content, and presence or absence of black beds or black mottling in 22 sediment cores taken from bottom sediment of southern Lake Michigan, Lineback et al. (1970) differentiate five more members (two red and three gray) and one bed. Colman and Foster (1990), who collected 55 cores from beneath Lake Michigan, were unable to consistently distinguish among the five members defined by Lineback et al. (1970); instead, they (Foster and Colman 1991) informally divided the Lake Michigan Formation into only two units (a lower, red unit and an upper, gray unit), which are separated by the Chippewa unconformity (Hough 1955, 1958) in shallow water and by a gradational color change in the deep bathymetric basins (fig. 9c). On the basis of high-resolution seismic-reflection profiles and seismic facies analysis, Foster and Colman (1991) interpreted the lower Lake Michigan Formation to be a distal facies of the more ice-proximal Equality Formation of Lineback et al. (1970) and Wickham et al. (1978). Foster and Colman (1991) suggested changes in rank and nomenclature were needed. In this report, the Lake Michigan Formation is downgraded in rank to a member of the Equality Formation, and the members and bed defined by Willman and Frye (1970) and Lineback et al. (1970) are dropped as formal lithostratigraphic units. The Lake Michigan Member is defined as the uppermost unit of the Equality Formation. The member occurs beneath Lake Michigan above the Chippewa unconformity and/or red, clay-rich sediment of the undivided Equality Formation (fig.9c). Like the stratified sand and gravel of the former Dolton Member, that of the Ravinia Sand Member is classified in this report as a facies (nearshore lacustrine) of the Henry Formation.

The Parkland Sand, as defined by Willman and Frye (1970), consists of windblown sand in dunes and sheetlike deposits between and bordering the dunes. In this report, the Parkland Sand is not retained as a formal unit. The well sorted, medium to fine grained sand, interpreted to be windblown, is included as an informal facies of the Henry Formation or a sandy facies of the Peoria Silt. The Parkland facies commonly occurs above glacial and postglacial fluvial and lacustrine sand and gravel of the Henry Formation and represents a reworked eolian facies of the Henry Formation. Where it interfingers or interbeds with the Peoria Silt, the Parkland facies may be more appropriately classified as a sandy facies of the Peoria Silt.

Other surficial formations defined by Willman and Frye (1970) (i. e., the Cahokia Alluvium, Grayslake Peat, Lacon Formation, and Peyton Colluvium) intertongue among themselves and sometimes with formations of the Mason Group. These postglacial units are not the subject of this report, but we recommend those with lithogenetic names be renamed (e. g., the Cahokia Alluvium to the Cahokia Formation and the Peyton Colluvium to the Peyton Formation). Future studies and mapping projects will address the reclassification of these units.

SUMMARY OF REVISIONS

Recent studies indicate the Sangamon Geosol is developed in deposits of the Winnebago Formation and the Lee Center and Esmond Till Members of the Wedron Formation. These units are no longer classified as the Wisconsinan Stage (Berg et al. 1985, Follmer and Kempton 1985, Curry and Kempton 1985). This change leaves the loess of the Roxana Silt as the main record for the early and middle parts of the Wisconsin Episode in Illinois, although deposits of the Equality and Henry Formations are also present in some basins and valleys (Curry 1989). The Roxana Silt is classified with the sorted sediment of the Mason Group. The Robein Silt is lowered in rank to a member of the Roxana Silt.

The Wedron Formation is raised to group rank (fig. 7); its upper boundary is extended to include the Two Rivers Member of the Kewaunee Formation in the Lake Michigan Lobe area. The Tiskilwa Till Member is raised to formation rank (Tiskilwa Formation); its lower boundary is extended to include gray diamicton formerly included in the Delavan and Fairgrange Till Members. The Delavan Till Member is classified as a formal unit (Delavan Member) in the Tiskilwa Formation, and the Fairgrange, Glenburn, and Oakland Till Members are dropped. The upper boundary of the Tiskilwa Formation is also extended to include gray diamicton formerly classified in the Piatt and Malden Till Members. The Piatt Till Member is retained as a formal unit (Piatt Member) in the Tiskilwa Formation, and the Malden Till Member is dropped.

The Lemont drift (Bretz 1939, 1955) is redefined as the Lemont Formation of the Wedron Group. In addition to the Lemont drift, the Lemont Formation includes deposits formerly included in the Batestown, Snider, Malden, Yorkville, and Haeger Till Members. The Batestown, Yorkville, and Haeger Till Members are retained as formal units (Batestown, Yorkville, and Haeger Members) in this revision, but they are included in the Lemont Formation. The lower boundary of the Yorkville Member is extended to include some diamicton units formerly included in the Snider and Malden Till Members. The latter two members are dropped.

The Wadsworth Till Member is raised to formation rank (Wadsworth Formation); it is not formally subdivided into members. The Kewaunee Formation (Mickelson et al. 1984) is recognized as the uppermost formation in the Wedron Group. Beneath Lake Michigan, the Kewaunee Formation consists of the Shorewood, Manitowoc, and Two Rivers Members. These units were formerly the Shorewood and Manitowoc Till Members of the former Wedron Formation and the Two Rivers Till Member of an unnamed formation. They were defined by Lineback et al. (1974) as tills that occur beneath Lake Michigan.

The Peoria Loess is renamed the Peoria Silt and classified with the sorted sediment of the new Mason Group. The Morton and Richland Loesses are not retained as units of formation rank in the present revision. Instead, they are included as tongues of the Peoria Silt that interfinger with parts of the Wedron Group. The lower tongue is formalized as the Morton Tongue, whereas the name Peoria Silt is applied to the unit beyond and above the Wedron Group (fig. 9a). The definitions of the Henry and Equality Formations are also modified to remove the genetic connotations. The Ashmore and Beverly Tongues are formalized as part of the Henry Formation, and the Peddicord Tongue is formalized as part of the Equality Formation. The Ashmore and Peddicord Tongues occur stratigraphically below the Tiskilwa Formation of the Wedron Group (fig. 9b, c); the Beverly Tongue occurs below the Haeger Member of the Lemont Formation. The fine grained, red, laminated sediment of the former Lake Michigan Formation is included in the Equality Formation, and the upper gray, laminated sediment is recognized as the Lake Michigan Member. The former members of the Lake Michigan Formation are not retained as formal lithostratigraphic units. The former members of the Henry and Equality Formations and the Parkland Sand were defined on the basis of genesis and/or morphology; therefore, they are not retained as formal members in this classification. This does not negate the utility of those units, however, and the names Batavia, Mackinaw, Wasco, Dolton, and Parkland will likely continue to be applied informally to the sedimentary facies for which they were intended. The Roxana and Peoria Silts and the Henry and Equality Formations are classified as formations in the new Mason Group.

TEMPORAL CLASSIFICATION

BACKGROUND

Although this report focuses on lithostratigraphic classification, placing the units in a temporal context helps to better understand the distribution of the lithostratigraphic units and their glacial history. The temporal classification used herein differs from that used in previous reports. It is based on the fact that the lithostratigraphic and pedostratigraphic units of the glacial record are clearly diachronous (time-transgressive). The 1983 Code (NACSN) offers a diachronic category for classification of temporal spans as an alternative to the geochronologic category, which is based on chronostratigraphic units that have time-synchronous rather than diachronous boundaries. Herein, we introduce a diachronic classification for the Wisconsin Episode in the Lake Michigan Lobe area (fig. 10). The episode is subdivided into subepisodes and phases on the basis of major geologic events inferred from lithostratigraphic and pedostratigraphic units in the sediment record.

The naming of temporal intervals of glacial activity in the North American midcontinent goes back to T. C. Chamberlin (1894, 1895), who referred to stages of glaciation (Kansan, Iowan, and Wisconsin stages) and to intervals of deglaciation that separated them. Although Chamberlin did not define or describe how he was using the term stage, his context indicates that he was referring to an interval of time during which a glacial formation of the same name (e. g., Kansan formation) was deposited. Leverett (1899, p. 19) clarified the usage of the term stage in his statement, "names of this class were proposed by Chamberlin as a substitute for time phrases which had arisen and which were of controverted application." The Wisconsin stage of glaciation was later subdivided by Leverett (1899) and Leverett and Taylor (1915); substages were named by Leighton (1933, 1960). Many of the substages represented major glacial readvances marked by the formation of morainic systems. For example, "the Bloomington substage covers the time of deposition of the Bloomington morainic system and all later moraines back to the Kalamazoo-Mississiniwa morainic system..." (Leverett and Taylor 1915, p. 31). The stages and substages of Chamberlin (1894, 1895) and Leverett (1899), thus, represent time intervals and events inferred from the spatial and morphologic relationships among drift units (formations), some of which are separated by forest beds and weathered zones.

The use of stage and substage as time terms in the Quaternary continued in North America, and such usage was sanctioned in the first stratigraphic code formulated in this country (Ashley et al. 1933). The 1933 Code (p. 446) specified that "... the time covered by a Pleistocene subdivision of formation rank is called a stage, and the time covered by a Pleistocene subdivision of member rank is called a substage." Such usage, however, conflicted with the use of stage as a time-stratigraphic unit, the accepted stratigraphic use of stage in the pre-Quaternary part of the geologic column. For this reason, the 1961 Code (ACSN) specifically rejected the use of stage and substage as time terms. It restricted stage to time-stratigraphic (chronostratigraphic) usage and designated the term age (when used in a formal sense) as a unit of geologic time (currently referred to as a geochronologic unit). The 1961 Code also introduced geologic-climate units for use in the Quaternary. Geologic-climate units (inferred widespread climatic episodes) were to be defined from subdivisions of Quaternary sediment. The only type of sediment specifically included, however, was glacial sediment. The terms glaciation, interglaciation, stade, and interstade were introduced as types of time units that, except for the climatic inference, were similar to those of Chamberlin and Leverett. These time units differed from geologic-time units in that their boundaries on a regional scale were not synchronous. Geologic-climate units were established in several regions (e. g., Rocky Mountains and eastern Great Lakes), but in the midcontinent region stage and substage continued to be used in most classifications (e. g., Leighton 1960), although there were exceptions (e. g., Gooding 1965).

TIME-STRATIGRAPHIC CLASSIFICATION OF WILLMAN AND FRYE

Frye and Willman's 1960 classification of the sediment (Wisconsinan Stage) and time (Wisconsinan Age) of the last glaciation in Illinois and Wisconsin was an attempt to apply time-stratigraphic and geologic time classifications adopted by the ISGS in 1958 (Willman et al.) to Pleistocene stratigraphy. In essence, Frye and Willman (1960) transposed the time units of the earlier geologists into material and time units with conceptual time-parallel boundaries and added adjectival endings to identify them as time-stratigraphic and geologic time units (e. g., Wisconsin Glaciation to Wisconsinan Stage/Age). In 1968, in an attempt to adhere to the prescribed procedures for definition of time-stratigraphic units put forth in the 1961 Code (ACSN), Frye et al. further clarified the definition of the Wisconsinan Stage for use in Illinois and Wisconsin by defining and describing lithostratigraphic units and their accompanying type sections. Time stratigraphy was included as one of four systems (rock, soil, morpho-, and time) of stratigraphic classification formally adopted by the ISGS in *Pleistocene Stratigraphy of Illinois* (Willman and Frye 1970; fig. 1).

The Wisconsinan Stage was defined as the body of rock that included all deposits from the contact of the Roxana Silt with the upper part of the Sangamon Soil at the base to the top of the Cochrane till and its contact with the overlying post-Cochrane deposits in the James Bay Lowland of Ontario, Canada (Frye et al. 1968). On the basis of the available radiocarbon ages for the Wisconsinan Stage, Frye et al. (1968) suggested an age range from about 75,000 to 7,000 radiocarbon years before present for the corresponding geologic-time unit, the Wisconsinan Age. More recent studies at and near type sections (McKay

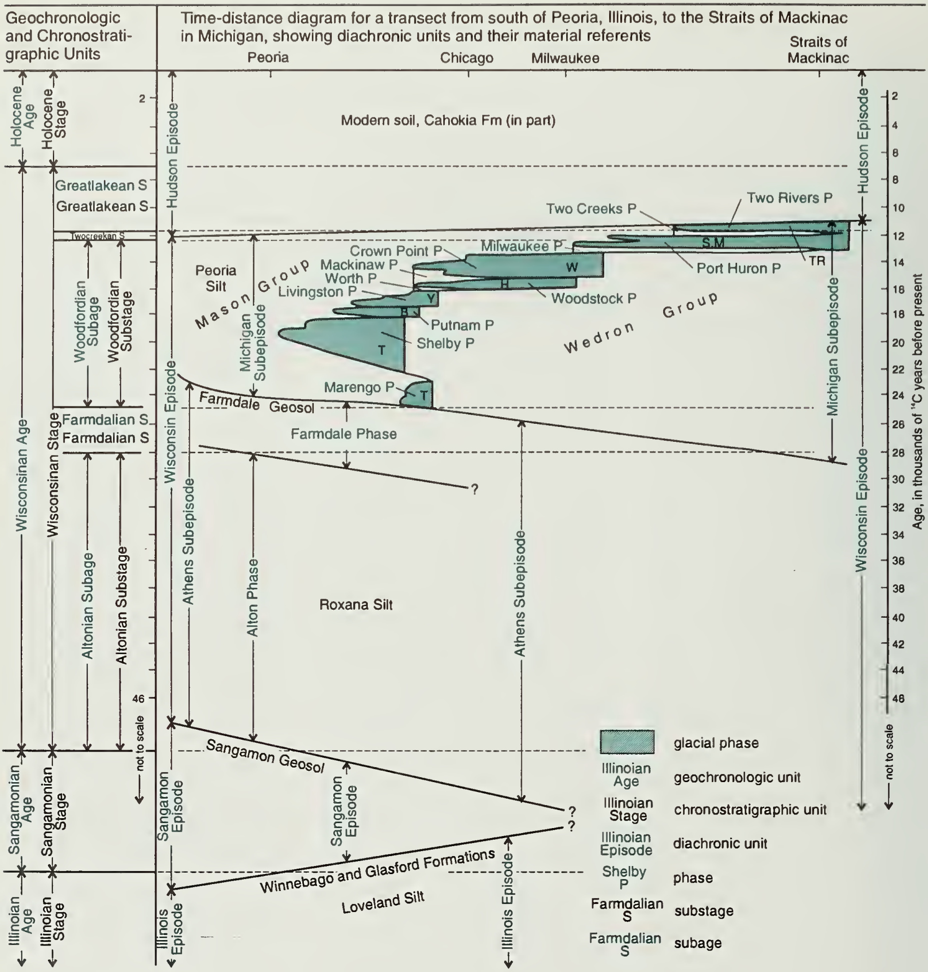


Figure 10 Geochronologic units, chronostratigraphic units and diachronic units in the Lake Michigan Lobe in a transect from south of Peoria, Illinois, to north of the Straits of Mackinac in Michigan (geochronologic and chronostratigraphic units are after Frye et al. 1968, as modified by Follmer et al. 1979, Curry and Follmer 1992, and Evenson et al. 1976; upper part of time-distance diagram and phases of the Michigan Subepisode are after Hansel and Johnson 1992). Material referents for the Hudson Episode are the modern soil and part of the Cahokia Formation. The Wedron Group and the Mason Group (Peoria Silt and most of the Henry and Equality Formations) are material referents for the Michigan Subepisode. Material referents for phases of the Michigan Subepisode include: Two Rivers Member (TR) for the Two Rivers Phase; lacustrine deposits and the Two Creeks forest bed for the Two Creeks Phase; Shorewood (S) and Manitowoc (M) Members for the Port Huron Phase; lacustrine deposits near Milwaukee, Wisconsin, and St. Joseph, Michigan, for the Mackinaw Phase; Wadsworth (W) Formation for the Crown Point Phase; lacustrine deposits near Milwaukee, Wisconsin, for the Milwaukee Phase; Haeger (H) Member for the Woodstock Phase; lacustrine deposits near Worth, Illinois, for the Worth Phase; Yorkville (Y) Member for the Livingston Phase; Batestown (B) Member for the Putnam Phase; and Tiskilwa (T) Formation for the Shelby and Marengo Phases. The Farmdale Geosol and Roxana Silt are material referents for the Athens Subepisode. The Sangamon Geosol is the material referent for the Sangamon Episode. The Glasford Formation (except Berry Clay Member) and the Loveland Silt are material referents for the Illinois Episode.

1979b, Curry and Follmer 1992) indicate the lower boundary of the Wisconsinan Stage is younger, about 50,000 radiocarbon years before present (fig. 10). Frye and Willman (1960) subdivided the Wisconsinan Stage into five substages. In ascending order, they are the Altonian, Farmdalian, Woodfordian, Twocreekan, and Valderan Substages.

The Woodfordian Substage includes the succession of deposits between the contact of Morton Loess with the Farmdale Silt (later Robein Silt; Willman and Frye 1970) and the base of the Two Creeks deposit in east-central Wisconsin (Frye et al. 1968). The concept of the Woodfordian Substage appears to be partially based on the fact that "no soils, leached zones, or widely traceable key horizons occur within the Woodfordian sequence" (Frye et al. 1968, p. E16). The Robein Silt (Farmdale Soil) and the Two Creeks forest deposit served as two fairly well-dated marker units bracketing the Woodfordian Substage. Frye and Willman (1960) and Frye et al. (1968) indicated the older bounding radiocarbon age for the Woodfordian Subage to be 22,000 years and younger bounding age to be 12,500 years before present. Both ages were modified as a result of subsequent studies near type sections (Follmer et al. 1979, Evenson et al. 1976), and the current bounding ages of the Woodfordian Substage are estimated to be 25,000 and 12,300 radiocarbon years before present (fig. 10).

The Twocreekan Substage was based on the Two Creeks deposits that, in the type area, consist of more than 10 feet (3 m) of lake clay locally overlain by silt and sand and the Two Creeks forest bed (Thwaites and Bertrand 1957). On the basis of available radiocarbon ages for the wood from the forest bed and the underlying lake deposits, Frye et al. (1968) suggested an age of 12,500 to 11,000 radiocarbon years before present for the Twocreekan Subage. In addition to the modification of the age of the lower boundary noted above, the upper boundary was also changed to 11,850 radiocarbon years before present (Evenson et al. 1976); together these changes shortened the duration of the Twocreekan Subage by more than 1,100 years (fig. 10).

Deposits above the Two Creeks organic horizon were included in the Valderan Substage, which was named for the Valders till of eastern Wisconsin described by Thwaites (1943) and Thwaites and Bertrand (1957). The upper limit of the Valderan Substage was defined as the top of the Cochrane till in Ontario (Frye et al. 1968). Evenson et al. (1976) argued, on the basis of studies that indicated the type Valders till was older than the Two Creeks forest bed, that the term Valderan was an inappropriate name for post-Twocreekan time and introduced the name Greatlakean as a direct replacement (fig. 10).

Frye and Willman's (1960) classification of the Wisconsinan Stage has been used in Illinois for the past three decades and followed in part by others (e. g., names like Wisconsinan, Woodfordian, Altonian, and Sangamonian have been applied and in some cases misused over fairly wide areas). Frye and Willman's classification was the first of only two temporal classification systems developed for and widely used within the Quaternary of the midcontinent; the other was introduced by Dreimanis and Karrow (1972) for use in the eastern Great Lakes and St. Lawrence region. Dreimanis and Karrow's classification includes aspects of both the time-stratigraphic/geologic time and the geologic-climate classifications. Terms such as stage and age, as well as stade and interstade, are included.

SHORTCOMINGS OF TIME-STRATIGRAPHIC CLASSIFICATION

Although Willman and Frye (1970) established both time-stratigraphic and geologic time systems, the geologic time system was rarely used. Climatic terms were often used with or in place of the geologic time term (e. g., headings in the geologic history portion of the *Pleistocene Stratigraphy of Illinois* (Willman and Frye 1970) include "Kansan Glaciation," "Yarmouthian Interglacial Age," and "Altonian Time"). In practice, many geologists in Illinois and elsewhere used the terms stage and substage not only in a chronostratigraphic (material) sense, but also in a geochronologic (time) sense.

In addition to the inconsistent use of the term stage, other aspects of the Frye and Willman (1960) classification system were criticized for several shortcomings. With respect to the classification of the Wisconsinan Stage (and Age), the three main shortcomings concern (1) the lack of a name for the deposits and time of the last (late Wisconsin) glaciation (Johnson et al. 1991, Hansel and Johnson 1992); (2) the lack of ranks below the substage (and subage) level (Wright 1964, Dreimanis and Karrow 1972, Evenson et al. 1976, Johnson et al. 1991, Hansel and Johnson 1992); and (3) the fact that the rock and soil unit boundaries on which the temporal classification is based are time-transgressive rather than time-parallel (Ruhe 1969, Fullerton 1979, Watson and Wright 1980, NACSN 1983, Curry and Follmer 1992).

Geologists well understand that boundaries of lithostratigraphic units on which the Wisconsinan Stage and its substages are based are time-transgressive rather than time-parallel. Fullerton (1979) noted that Willman (1979) clearly recognized a problem in using time-stratigraphic classification with diachronous referents, as indicated in the statement, "characteristically, the boundaries of glacial and glaciofluvial deposits do not conform closely to time planes, and the time planes, therefore, are accurately fixed only in their type sections.... Although the soils, particularly the Sangamon Soil, are among the most useful units for regional correlation, their boundaries do not make good time planes for establishing conventional time-stratigraphic units" (Willman 1979, p. 93–94).

EVENT AND DIACHRONIC CLASSIFICATIONS

Wright (1964) specifically pointed out the need for smaller units of time for deposits and glacial advances (events) within a region, so that they could be correlated with those of other regions. He introduced the term phase to designate "a time of glacier activity, whether identifiable by stratigraphy or morphology" (Wright 1964, p. 630). Phases have been widely used in the subsequent Quaternary literature on Minnesota. Likewise in North Dakota, Clayton (1966) used the term phase for minor glacial advances, which he considered as subdivisions of stades in the geologic-climate classification. He noted that phases refer to "episodes or units of time rather than bodies of rock." Wright (1964) indicated this approach was essentially the same as that used by Chamberlin, Leverett, and Leighton in their earlier classifications. Clayton (1966), by relating phases to the geologic-climate units of the 1961 Code, implied that the geologic-climate unit was also a type of event classification. Since the early 1960s, event classification has been increasingly applied in the midcontinent (e. g., Wright and Ruhe 1965, Clayton and Moran 1982, Attig et al. 1985), and the term phase has also been used for Quaternary lake events (e. g., Clayton 1983, Teller and Thorleifson 1983, Hansel et al. 1985b).

Although event units (phases) were originally defined as time units related to inferred events (Wright 1964, Clayton 1966), some geologists today emphasize the event rather than the temporal aspect of the units. For example, Clayton et al. (1992) state that phase (as well as glaciation) is used for an event rather than a period of time. Regardless of which aspect is emphasized, the two are coextensive, and event classification in practice includes not only the event, but also the time (duration) of the event.

The North American Commission of Stratigraphic Nomenclature dropped geologic-climate units from the 1983 Code because of the subjective nature of interpreting climate. Although more general event units were proposed, they too were excluded as formal unit categories by the Code Committee for similar reasons (i. e., the proposed units were considered to be interpretive). The Code Committee, influenced by Watson and Wright's (1980) criticism of chronostratigraphic classification, introduced in the 1983 Code a new type of temporal unit, the diachronic unit. "A diachronic unit comprises the unequal spans of time represented either by a specific lithostratigraphic, allostratigraphic, biostratigraphic, or pedostratigraphic unit, or by an assemblage of such units" (NACSN 1983, p. 870, Art. 91). Based on the time-transgressive material units, diachronic units refer to the time during which the material referent was deposited or originated. In essence, diachronic units are similar to the time units of Chamberlin and Leverett, the geologic-climate units of the 1961 Code (except a climatic inference is not required), the geologic-time units of Frye and Willman (1960) as actually practiced (but not conceptually defined), and many of the temporal aspects of geologic-event units as originally described by Wright (1964) and Clayton (1966). Diachronic units differ from geologic-event units in that (1) the emphasis is temporal, (2) material referents are designated, (3) morphologic or other nonstratigraphic criteria are not explicitly included in the Code as a basis for their definition, and (4) no mention is made of inferred events. Although the 1983 Code does not state that diachronic units are intended to delineate the time of geologic events, such a delineation is suggested by the purposes specified for the definition of diachronic units. For example, the phrases, "a basis for broadly establishing in time the beginning and ending of deposition of diachronous stratigraphic units at different sites" and "a means of comparing temporal and spatial relations of diachronous stratigraphic units" (NACSN 1983, p. 870), suggest that the stratigraphic unit(s) on which a diachronic unit is based probably relates to some geologic event. It seems unlikely that diachronic units would be meaningful or useful unless they were established to delineate times of historical significance as inferred from the sediment record. Thus, we conclude diachronic units and their material referents (the sediment evidence for an event) serve a similar temporal function as that of geologic-event units.

The 1983 Code suggests the temporal classification schemes of Frye and Willman (1960), Frye et al. (1965), Willman and Frye (1970), and Dreimanis and Karrow (1972) could be replaced by diachronic systems and well-established names could be retained where appropriate, if the temporal classifications are formally abandoned and new units are defined as diachronic units. The problems inherent in attempting to apply time-stratigraphic classification for the Quaternary have led to confusion and poor understanding of stratigraphic concepts and nomenclature among Quaternary scientists; therefore, we do not follow that classification system below the rank of epoch in this report.

As a result of discussions with other Quaternary stratigraphers in the midcontinent region, particularly in Illinois, Wisconsin, Michigan, Iowa, Ohio, and Ontario, we have agreed to use the same names to the extent practical for either the events or the temporal intervals of the events of the late Quaternary in the Great Lakes region (Johnson et al. in preparation). We herein establish for formal use a diachronic system incorporating the names agreed upon in our discussions. The diachronic system introduced is an alternative classification to existing geochronologic and chronostratigraphic classifications, which are not formally abandoned in Illinois. To avoid redundancy and confusion, we recommend the two systems not be used simultaneously in the same report.

DIACHRONIC CLASSIFICATION

The diachronic system used in this report is generally similar to that described in the 1983 Code, although it does not follow the Code in all respects. The hierarchy of event intervals includes, in order of decreasing rank, episode, subepisode, phase, and subphase (although no subphases are designated at this time). Long-standing names in midcontinent temporal nomenclature are retained, but they are used in noun form to clearly differentiate them from their adjectival form used in the chronostratigraphic-geochronologic classification in Illinois. The nomenclatural system is similar to the existing system, and we have attempted to use the names in the same general sense as they are currently used to avoid confusion (fig. 10). The main differences are

- proper name is in noun form;
- terms stage, age, substage, and subage are not used in a formal stratigraphic sense;
- relative rank of some units has changed;
- units are based on lithostratigraphic or pedostratigraphic units with time-transgressive boundaries; thus, the temporal units have diachronous boundaries;
- type sections for the diachronic units are not designated; they are based on material units that have type and reference sections, or on portions of formal units that have reference sections or morphologic identity;
- new names in Illinois are suggested for the postglacial episode (Hudson Episode) and for two subepisodes (Athens and Michigan Subepisodes) of the Wisconsin Episode. Hansel and Johnson (1992) have already described and used portions of the diachronic system.

Illinois and Sangamon Episodes

The Illinois Episode is based on the Glasford (except the Berry Clay Member), Winnebago, and Pearl Formations and the Petersburg, Teneriffe, and Loveland (as used in Illinois) Silts (Willman and Frye 1970; plate 1). It covers the same general time interval as the Illinoian Stage/Age in Illinois. The Sangamon Episode is based on the Sangamon Geosol (Follmer 1983) and covers the same time interval as the Sangamonian Stage/Age (Curry and Follmer 1992), except the lower and upper boundaries are not fixed in time.

Wisconsin Episode

In Illinois, the Wisconsin Episode is based on the Roxana Silt, the

Farmdale Geosol, the Wedron Group, and most of the Mason Group, as these units are used and revised in this report (plate 1). The Wisconsin Episode is generally similar in concept to the Wisconsinan Age of Willman and Frye (1970). It is subdivided into two subepisodes in Illinois: the Athens Subepisode, which includes the Alton and Farmdale Phases; and the Michigan Subepisode, which includes 12 phases. The Athens Subepisode is named for Athens, Illinois, and the Athens Quarry sections where the Roxana Silt (including the Robein Member) and the Farmdale Geosol were described (Follmer et al. 1979, Curry and Follmer 1992). The Alton and Farmdale Phases of the Athens Subepisode represent intervals of loess deposition (Roxana Silt) and soil formation (Farmdale Geosol), respectively. The Roxana Silt and Farmdale Geosol are the material referents for the phases. Except for their diachronous boundaries, the Alton and Farmdale Phases are similar in concept to the Altonian and Farmdalian Subages of Willman and Frye (1970). The Athens Subepisode generally coincides in time with the middle Wisconsin(an) (as the term is used, e. g., in Richmond and Fullerton 1986), but no specific temporal boundaries or correlations are intended.

The Michigan Subepisode refers to the event interval of the last major glaciation, often referred to as the late Wisconsin(an) or the "main" or "classical" Wisconsin. It is named for the state of Michigan, which was completely covered by ice during part of this glacial event; deposits of the event in what is now Michigan and the rest of the Great Lakes region are the material referents. In Illinois, the Michigan Subepisode is based on the Wedron Group and those deposits of the Mason Group that occur stratigraphically above the Farmdale Geosol and below the top of the Peoria Silt. The Michigan Subepisode is similar in concept to the Woodfordian, Twocreekan, and Valderan (Greatlakean, Evenson et al. 1976) Subages of Willman and Frye (1970). It provides a long-needed name for the last glaciation since the term Wisconsin was broadened to include the deposits and events of the "early" and "middle" Wisconsin episode of glaciation. Eight phases in the Michigan Subepisode (Marengo, Shelby, Putnam, Livingston, Woodstock, Crown Point, Port Huron, and Two Rivers Phases) represent intervals of glacier activity. Each interval began with a major advance or readvance of the Lake Michigan Lobe in Illinois or the Lake Michigan basin. These glacial phases are represented by glacigenic sequences consisting of deposits included in the Wedron Group diamicton units (the Tiskilwa Formation; the Batestown, Yorkville, and Haeger Members, and undivided Lemont Formation; the Wadsworth Formation; and the Shorewood, Manitowoc, and Two Rivers Members, and undivided Kewaunee Formation) and in the Mason Group sorted-sediment units (especially those of the Peoria Silt and the Henry and Equality Formations). Deglacial phases also can be recognized. They are represented by proglacial lacustrine, fluvial, and/or organic deposits of the Mason Group that are present between diamicton units of the Wedron Group. Only four deglacial phases, the Worth (Johnson and Hansel 1989), Milwaukee (Schneider and Need 1985, Hansel and Johnson 1992), Mackinaw (Evenson et al. 1976, Hansel and Johnson 1992), and Two Creeks Phases (Evenson et al. 1976, Hansel and Johnson 1992), are designated in this report.

Radiocarbon age control for the phases of the Michigan Subepisode is discussed and summarized in Hansel and Johnson (1992) and is the basis for boundaries in figure 10. Age control for the phases is based on age control for the lithostratigraphic units of the Wedron and Mason Groups (appendix B).

Hudson Episode

The Hudson Episode is named for Hudson Bay, which, located in a central position relative to the Laurentide Ice Sheet, came into existence as the ice sheet disintegrated during deglaciation. Material referents for the episode are marine and lacustrine sediment deposited in and around what is now Hudson Bay during and since deglaciation (Lee 1960, Shilts 1984). From a diachronic standpoint, the Hudson Episode represents postglacial time in regions that were covered or influenced by the Laurentide Ice Sheet. In Illinois, the Hudson Episode is based on the modern soil developed in the Wedron Group, Peoria Silt, or Mason Group deposits equivalent to or older than the Peoria Silt (plate 1). Portions of the Cahokia Formation and other surficial units were deposited during the Hudson Episode in Illinois.

DEFINITION OF LITHOSTRATIGRAPHIC UNITS

The lithostratigraphic units of the Wedron and Mason Groups are defined and/or revised below according to the guidelines set forth in the North American Stratigraphic Code (NACSN 1983). Definition is the original naming and description of a unit. Redefinition is a correction or change in the descriptive term applied to a stratigraphic unit; redefinition does not require a new geographic term. Redescription corrects an inadequate or inaccurate description. Revision involves either minor changes in the definition of one or both boundaries, or in the unit's rank. Reclassification applies when the hierarchical unit with which a subunit is classified changes, but the subunit's rank and name remain the same. Definition, redefinition, revision, or abandonment of a formal unit requires publication of a comprehensive statement that includes the following: (1) the intent to designate or modify a formal unit, (2) designation of category and rank of unit, (3) selection and derivation of name, (4) specification of type section or type locality, (5) description of unit, (6) definition of boundaries, (7) historical background, (8) dimensions, shape, and other regional aspects, (9) geologic age, (10) correlations, and (11) genesis, where applicable (NACSN 1993, p. 851). References for and revisions of formerly published reference sections and their locations, as well as descriptions of new reference sections presented below, are included in appendix C.

WEDRON GROUP

Status

Revised unit. Elevated in rank from the Wedron Formation (Frye et al. 1968, Willman and Frye 1970); upper boundary extended to top of the Two Rivers Member of the Kewaunee Formation (Mickelson et al. 1984); the Esmond and Lee Center Till Members now classified as the Glasford Formation (Berg et al. 1985).

Source of name Wedron, a village along the Fox River in La Salle County, northeastern Illinois.

Original name Wedron Formation (Frye et al. 1968).

Type section Wedron Section, Wedron Silica Company quarries at Wedron, Illinois; good for lower boundary and lithology (Tiskilwa Formation and lower part of Lemont Formation). Original section was destroyed by mining.

Principal reference sections

Farm Creek Section and Higginsville Section; good for lower boundary and lithology (Tiskilwa Formation). Land and Lakes Landfill Section; good for lithology (upper part of Lemont Formation and Wadsworth Formation). Cedarburg Lake Bluff Section and Kewaunee Section, Wisconsin; good for lithology (Kewaunee Formation and Wadsworth-equivalent Oak Creek Formation).

Definition

The Wedron Group comprises a succession of diamicton formations that interfinger with sorted-sediment formations of the Mason Group. The succession is subdivided from the base upward into the Tiskilwa, Lemont, Wadsworth, and Kewaunee Formations (fig. 7).

Background

The Wedron Formation was originally defined by Frye et al. (1968), and later subdivided into members by Willman and Frye (1970; fig. 4b). Frye et al. defined the Wedron Formation as the succession of diamictons and associated sediments from the contact of the Morton Loess (or the Robein Silt in the absence of the Morton Loess) to the top of the diamicton below the Two Creeks deposit at Two Creeks, Wisconsin. Because several units within the succession are now recognized as formations (i. e., the Tiskilwa, Lemont, and Wadsworth), the Wedron is raised in rank to group status. Accepting the lithostratigraphic framework established for the Lake Michigan Lobe in Wisconsin by Mickelson et al. (1984), we classify the red till members (the Shorewood, Manitowoc, and Two Rivers) identified in Lake Michigan by Lineback et al. (1974) as members of the Kewaunee Formation of Wisconsin. The upper boundary of the original Wedron Formation is thus extended to include the Two Rivers Member of the Kewaunee Formation as part of the Wedron Group (fig. 7). Although the Wedron Group is defined on the basis of deposits in Illinois and Lake Michigan, the group also provides a useful regional concept (figs. 8, 11).

Description

The Wedron Group consists of multiple diamicton units that contain lenses of clay, silt, sand, gravel, and occasionally humic material and wood. It intertongues with sorted-sediment units of the Mason Group (fig. 2), most commonly the Peoria Silt and Henry and Equality Formations (figs. 9, 12). The succession contains considerable lithic heterogeneity among diamicton units. Matrix texture of diamicton ranges from fine to coarse, and the percentage of gravel-sized clasts ranges from about 2% to 5% in fine grained diamicton to up to 20% in coarse grained diamicton. Matrix diamicton color ranges from gray to

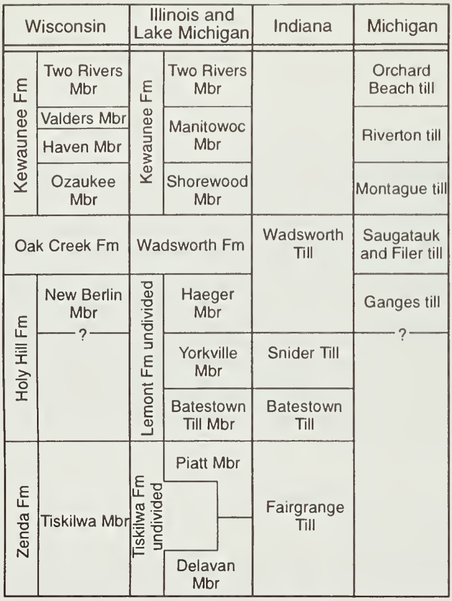


Figure 11 Correlation of the Wedron Group formations and members in the Lake Michigan Lobe area (units in Wisconsin from Mickelson et al. 1984, Mickelson and Syverson, in press; units in Indiana from Bleuer et al. 1983, N.K. Bleuer, Indiana Geological Survey, personal communication, 1994; units in Michigan from Monaghan and Larson 1986, Monaghan et al. 1986, Taylor 1990).

Figure 12 Intertongued sorted-sediment units of the Mason Group and diamicton units of the Wedron Group at Wedron Quarry pit 1. Mason Group units are shaded.

gray brown, red gray, or red brown, and typically oxidizes to olive brown, brown, yellow brown, or red brown. The Wedron Group is subdivided into four formations and eight members in Illinois and Lake Michigan (fig. 7). The entire Wedron Group succession is not known to be present in any one place. From the base upward the ideal succession includes the following:

Tiskilwa Formation consisting of red to gray, medium textured diamicton units;

Lemont Formation consisting of a succession of gray, fine to coarse textured diamicton units;

Wadsworth Formation consisting of gray, fine grained diamicton units;

Kewaunee Formation containing red, fine textured diamicton units.

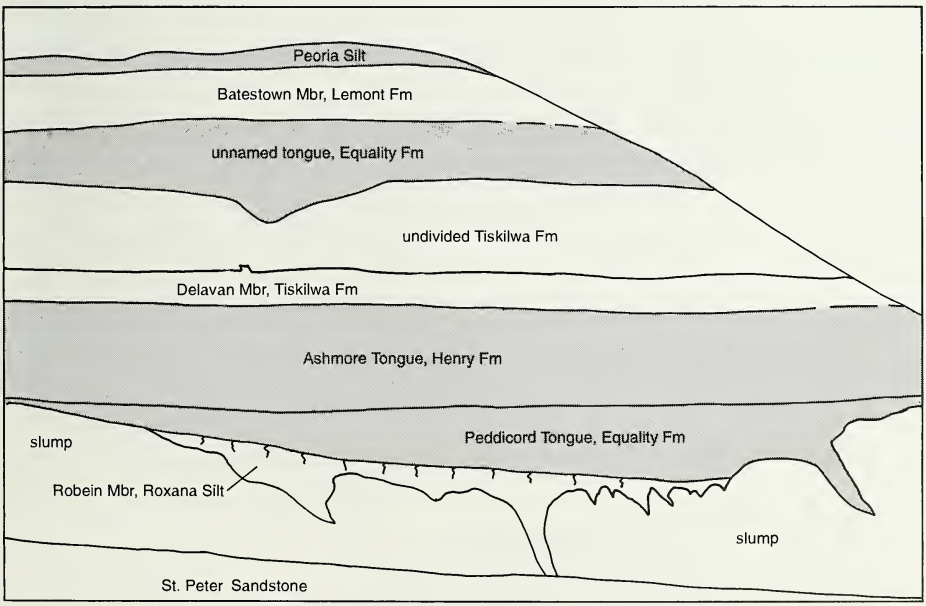
All the formations contain lenses of sorted sediment and intertongue, at least locally along their margins, with stratified sand and gravel of the Henry Formation and bedded silt and clay of the Equality Formation.

Boundaries
Lower boundary: the contact with the Ashmore Tongue of the Henry Formation, the Peddicord Tongue of the Equality Formation, the Morton Tongue of the Peoria Silt, the Robein Member or undivided Roxana Silt, or older units. Upper boundary: the contact with upper tongues of the Peoria Silt and Henry and Equality Formations, the Trafalgar Formation (fig. 13b), or postglacial units.

Differentiation from other units
The Wedron Group is readily distinguishable from the sorted-sediment formations of the Mason Group. Diamicton units of the Wedron Group can generally be differentiated from those of the underlying formations on the basis of their lithic characteristics, but in some cases the stratigraphic relationships of Wedron diamicton to key pedostratigraphic units (like the Farmdale or Sangamon Geosols) are necessary. Lenses and bodies of material derived from the underlying units locally occur within the Wedron Group.

Regional extent and thickness
Except for the few areas where bedrock crops out, the Wedron Group is at or near the surface in northeastern Illinois (plate 1), northwestern Indiana, eastern Wisconsin, the western part of the lower peninsula of Michigan, and the Lake Michigan basin (fig. 8). The thickness of the Wedron Group varies. Although the Wedron Group may reach 75 to 90 meters (246–295 ft) thick in some of the larger moraines in Illinois, it averages about 30 meters (98 ft) thick in much of Illinois and locally is less than 1 meter thick in some regions of the Lake Michigan Lobe area.

Origin
The Wedron Group consists predominantly of till that contains lenses of subglacial and supraglacial fluvial, lacustrine, and debris-flow sediment. This sediment together with intertonguing proglacial eolian, lacustrine, and fluvial sediment of the Mason Group makes up multiple glacigenic sequences. The glacigenic sequences have



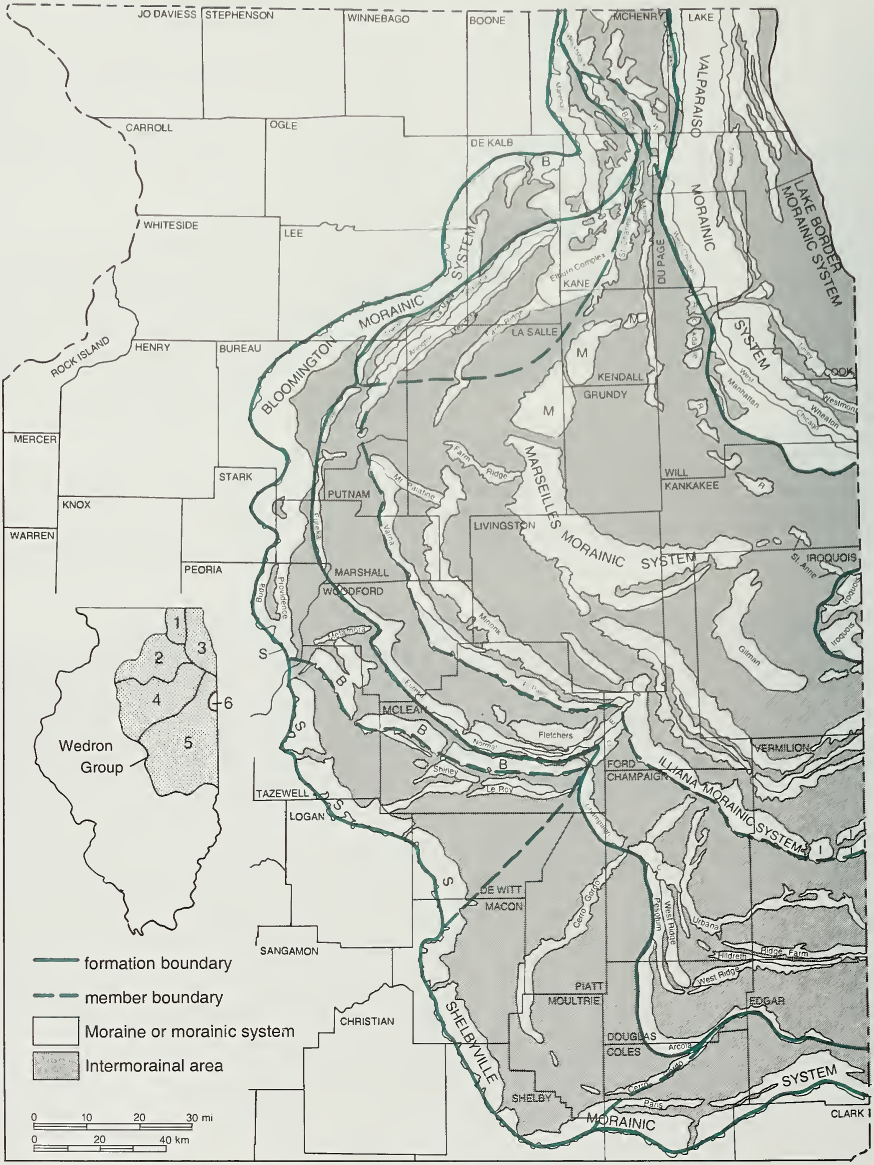


Figure 13a Areal distribution of moraines and boundaries of formations and predominant members of the Wedron Group and the Trafalgar Formation in Illinois. (Names of formations and members are labeled on 13b.) Sublobe areas of the Lake Michigan Lobe and the Huron-Erie Lobe are shown on inset map: (1) Harvard; (2) Princeton; (3) Joliet; (4) Peoria; (5) Decatur; and (6) Huron-Erie (sublobe areas and moraines are modified from Willman and Frye 1970).

a shingled occurrence, and they pinch out in the subsurface beneath younger sequences. Rarely do more than two or three glacigenic sequences occur in succession, and most sections expose only parts of one or two sequences.

Age and correlation

The Wedron Group was deposited during the Michigan Subepisode, between about 26,000 and 11,000 radiocarbon years ago (fig. 10). It correlates with equivalent units of the Lake Michigan Lobe (fig. 11) in Wisconsin (i. e., Tiskilwa Member, Zenda Formation; New Berlin Member, Holy Hill Formation; Oak Creek Formation; and Kewaunee Formation), in Indiana (i. e., Fairgrange, Batestown, Snider, and Wadsworth Tills), and in Michigan (i. e., Ganges, Saugatauk, Filer, Montague, Riverton, and Orchard Beach tills.

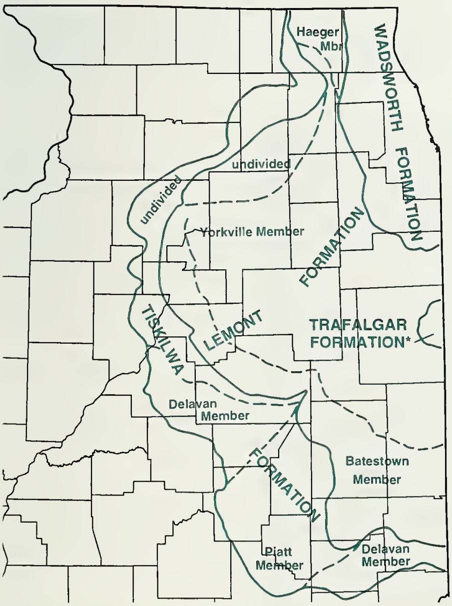
Tiskilwa Formation

Status

Revised unit. Elevated in rank from the Tiskilwa Till Member (Willman and Frye 1970); lower boundary extended to include the Delavan Member, originally defined as a separate till member of the Wedron Formation (Willman and Frye 1970); upper boundary extended to include the Piatt Member, originally defined as a member of the Wedron Formation (Wickham 1979a).

Source of name Tiskilwa, a village in Bureau County, northern Illinois.

Original name Tiskilwa Till Member (Willman and Frye 1970).



*not part of Wedron Group

Figure 13b Names of Wedron Group formations and members in Illinois.

Type section Buda East Section, located in a roadcut 5 miles (8 km) east of Tiskilwa. No longer exposed.

Principal reference sections

Wedron Section (fig. 12); good for upper and lower boundaries and lithology. Danvers Section; good for lower boundary and lithology. Higginsville Section (fig. 14); good for upper and lower boundaries and lithology.

Definition

The Tiskilwa Formation is the lowermost sequence of red to gray diamicton units of the Wedron Group. Two grayer diamicton members (a lower Delavan Member and an upper Piatt Member) are differentiated from the main body of red gray diamicton (fig. 7).

Background

The Tiskilwa Till Member was originally defined by Willman and Frye (1970) and described as the pink till member of the Wedron Formation. The Tiskilwa Till Member has become a fundamental unit in describing and interpreting the geology in the area of the Lake Michigan Lobe. It is readily recognized by its red or pink hues. It is the thickest and volumetrically the most extensive unit of the Wedron in Illinois (Wickham and Johnson 1981, Wickham et al. 1988).

The relationship of the lower tills of the Wedron Group across the Decatur-Peoria Sublobe boundary area stimulated further study in the 1970s, probably in part because Willman and Frye (1970) did not subdivide the Wedron Formation in the Decatur Sublobe area (fig. 4a). With the exception of Chamberlin (1883, 1894), Leverett (1899), and Leverett and Taylor (1915), many geologists (Leighton et al. 1948, Horberg and Anderson 1956, Anderson 1955, 1957, Leighton 1960, Frye et al. 1965, Willman and Frye 1970, Frye and Willman 1973, Dreimanis and Goldthwait 1973) attributed the drift of the Decatur Sublobe area to a more eastern source than the Lake Michigan basin. This interpretation was mainly based on moraine configurations. Studies of the tills across the sublobe-boundary area, however, indicate lithologic similarities between tills of the Peoria and Decatur Sublobes (Wascher and Winters 1938, Newell 1954, Kempton et al. 1971). McKay (1975) and Moore (1981) argued that till members are continuous across the sublobe boundary and were deposited by the Lake Michigan Lobe. A Lake Michigan Lobe source for the till members in the Decatur Sublobe area is also indicated from recent provenance studies (Bleuer 1975, Johnson et al. 1986).

In the decade that followed the publication of *Pleistocene Stratigraphy of Illinois* (William and Frye 1970), six till members and one nontill member were differentiated within the Wedron Formation in the area of the Decatur Sublobe. They include the Glenburn, Batestown, and Snider Till Members (Johnson et al. 1971b); the Oakland and Fairgrange Till Members and the Ashmore Member (Ford 1973); and the

Piatt Till Member (Wickham 1979a). All of these except the Glenburn and Oakland Till Members and the Ashmore Member were recognized on the state Quaternary map compiled by Lineback in 1979 (fig. 5).

In 1976, Johnson correlated the Glenburn, Oakland, and Fairgrange Till Members of east-central Illinois (Decatur Sublobe) with the Tiskilwa and Delavan Till Members of central and northern Illinois (fig. 7). He suggested these units formed a lower, medium-textured group of Wedron Formation till members. (The Lee Center Till Member of northeastern Illinois was also included in this group, but it has since been interpreted to underlie the Sangamon Geosol [Follmer and Kempton 1985]).

On the basis of the preceding work and in an attempt to simplify the classification system that evolved for the lower part of the Wedron Group, we elevate the Tiskilwa Member to a formation that includes two lithologically related, mappable subunits (figs. 7, 13). They are (1) the Delavan Member, proposed by Willman and Frye (1970), which is expanded in concept and regional extent to include the former Glenburn, Oakland, and Fairgrange Till Members of the Decatur Sublobe area; and (2) the Piatt Member, proposed by Wickham (1979a). The Ashmore Member, proposed by Ford (1973), is recognized herein as the Ashmore Tongue of the Henry Formation.

Where undivided, the Tiskilwa Formation consists predominantly of red and pink loam to clay loam diamicton. Diamicton of the Delavan Member is more gray and considered a lithologic variant of the main diamicton of the Tiskilwa Formation. It occurs stratigraphically below (in the Princeton, Harvard, and northern part of the Peoria Sublobe areas) or replaces (in the southern part of the Decatur and Peoria Sublobe areas) the main pink diamicton of the Tiskilwa Formation (fig. 13). The Piatt Member, a sandier, grayer facies of the Tiskilwa Formation, occurs stratigraphically above the Delavan Member in part of the Decatur Sublobe area (figs. 7, 13).

The Oakland Till Member proposed by Ford (1973) is replaced herein by the Oakland facies, a lithologic variant of the Delavan Member or the undivided Tiskilwa Formation. Diamicton of the Oakland facies is browner, siltier, more abundant in expandable clay minerals, and generally more variable than typical diamicton of the Tiskilwa Formation (Johnson et al. 1972, Ford 1973, Johnson 1976). It is a discontinuous, basal facies of the Tiskilwa Formation; thicknesses up to about 4 meters were reported from exposures and cores in east-central Illinois (Johnson et al. 1972, Ford 1973, Johnson 1976). Ford (1973) attributed the browner color and distinct clay-mineral composition of the Oakland diamicton to glacial incorporation of the Roxana Silt, including the organic-rich Robein Member.

Description

The Tiskilwa Formation consists of calcareous, red gray to gray, medium textured (clay loam to loam) diamicton that contains lenses of gravel, sand, silt, and clay. Typically, it oxidizes to red brown, brown, or yellow brown.

Boundaries

Lower boundary: the contact with the Ashmore Tongue of the Henry Formation, the Peddicord Tongue of the Equality Formation, the Morton Tongue of the Peoria Silt, the Robein Member or undivided Roxana Formation (in which the Farmdale Geosol is developed), or older units. Upper

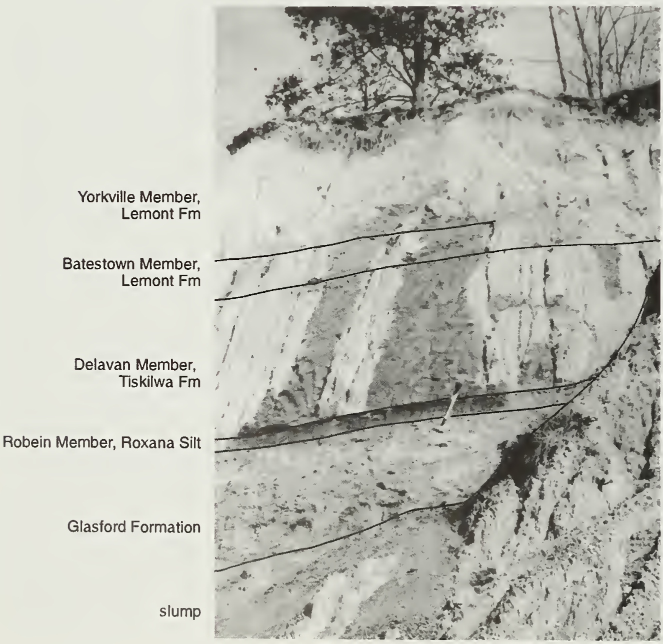


Figure 14 The Yorkville and Batestown Members of the Lemont Formation, Delavan Member of the Tiskilwa Formation, Robein Member of the Roxana Silt, and Glasford Formation at Higginsville Section.

boundary: the contact with the Batestown, Yorkville, or Haeger Members of the Lemont Formation, upper tongues of the Peoria Silt and Henry and Equality Formations, or postglacial units.

Differentiation from other units
Diamicton of the Tiskilwa Formation is readily distinguishable from sorted sediment of the Mason Group. In places in the subsurface, the contact with the organic-rich Robein Member of the Roxana Silt is a distinctive marker for recognizing the base of the Tiskilwa Formation. Where the Tiskilwa Formation overlies older diamicton units, the units can usually be differentiated on the basis of lithology. Where present, the Sangamon Geosol helps to differentiate these older diamicton units from those of the Tiskilwa Formation. Lenses of the underlying units may be within the Tiskilwa Formation, particularly the basal part, but they are usually accompanied by evidence of subglacial deformation. Locally, the Oakland facies may be present as a basal diamicton facies. Diamicton of the Tiskilwa Formation generally contains more clay and is redder than that of the overlying Batestown Member of the Lemont Formation. In some areas where the Delavan or Piatt Members are in contact with the Batestown Member, however, the lithologies of these units are quite similar, and arbitrary boundaries along the outer margins of moraines may be necessary to separate the units for mapping purposes.

Regional extent and thickness
The Tiskilwa Formation forms a wedge-shaped deposit that pinches out beneath the Lemont Formation to the north and east (fig. 13). It is volumetrically the largest formation of the Wedron Group in Illinois. It forms the surface unit in the outermost moraines of the Harvard, Princeton, Peoria, and Decatur Sublobe areas in Illinois, where in some places it reaches thicknesses up to 90 meters (295 ft) (Wickham et al. 1988).

Origin
The Tiskilwa Formation consists of part(s) of one or multiple glacigenic sequences. Over much of Illinois the glacigenic sequences represented by the Tiskilwa Formation and the interfingered tongues of the Peoria Silt and Henry and Equality Formations appear fairly complete (e. g., Wedron Section), suggesting that deposition clearly dominated over erosion in the marginal areas of the Lake Michigan Lobe during the Michigan Subepisode (Johnson and Hansel 1990).

Age and correlation
The Tiskilwa Formation was deposited during the early part of the Michigan Subepisode (Marengo and Shelby Phases) between about 26,000 and 18,500 radiocarbon years ago (Hansel and Johnson 1992). The Lake Michigan Lobe advanced to its maximum position in the Harvard Sublobe area (Marengo Moraine) about 25,000 radiocarbon years ago; it reached its maximum position in the Princeton, Peoria, and Decatur Sublobe areas (Bloomington and Shelbyville Morainic Systems) about 20,000 radiocarbon years ago before it wasted back about 50 kilometers (31 mi; fig. 10). The Tiskilwa Formation correlates with the Tiskilwa Member of the Zenda Formation in Wisconsin (fig. 11) and the Fairgrange Till in Indiana.

Delavan Member

Status
Reclassified unit. Name changed to the Delavan Member, unit classified as part of the Tiskilwa Formation, and unit description broadened to include lithologically similar and stratigraphically equivalent diamicton (Fairgrange, Oakland, and Glenburn Till Members of the Decatur Sublobe area). Formerly classified as the Delavan Till Member of the Wedron Formation (Willman and Frye 1970).

Source of name Delavan, a village in Tazewell County, central Illinois.

Original name Delavan Till Member (Willman and Frye 1970).

Type section Roadcuts along Illinois Highway 121, 4 miles (6.4 km) east of Delavan. No longer exposed.

Principal reference sections
Danvers Section; good for boundaries and lithology. Farm Creek Section; good for lower boundary and lithology. Wedron Section (fig. 12) and Higginsville Section (fig. 14); good for boundaries and lithology.

Definition
The Delavan Member consists of the lower gray to brown or violet gray loam diamicton beds of the Tiskilwa Formation. Locally the Delavan Member is pinkish and similar to the undivided Tiskilwa Formation. Diamicton of the Delavan Member oxidizes to brown, yellow brown, or pink.

Background
The Delavan Till Member was originally defined by Willman and Frye (1970); it was described as gray, silty, illitic till of the Peoria Sublobe area and up to 200 feet (61 m) thick in the Shelbyville Morainic System (fig. 13). In earlier reports diamicton of the Delavan Till Member was often referred to as Shelbyville till or drift (e. g., Frye et al. 1962).

In 1970, Willman and Frye did not subdivide the Wedron Formation into members in the Decatur Sublobe area (fig. 4), but in the decade that followed six till members and one nontill member of the Wedron Formation were defined for that area (Johnson et al. 1971b, Ford 1973, Wickham 1979a). In 1976, Johnson correlated three of the till members of the Wedron Formation of the Decatur Sublobe area (the Glenburn, Oakland, and Fairgrange Till Members) with the Tiskilwa and Delavan Till Members of the Peoria Sublobe area. These three units formed a lower, medium-textured group of Wedron tills (fig. 7).

The Glenburn Till Member was defined by Johnson et al. (1971b) as a brownish gray, loam till that oxidizes to a distinct brown or pink. It was defined in the Danville region, where it is primarily a subsurface unit. Although Johnson et al. (1971b) believed it to be part of the Woodfordian Substage and to correlate with subsurface Woodfordian tills to the west (Kempton et al. 1971), a radiocarbon age of 38,000 years for wood from near the base of the unit left its age equivocal.

The Fairgrange Till Member was defined by Ford in 1973 and described as an olive brown to light brownish gray, loam till that is sometimes pinkish; its type locality is in the Charleston Stone Quarry pits. Ford (1973) suggested the Fairgrange Till Member correlated with the Tiskilwa

Figure 15 Lower tongues of the Mason Group Henry and Equality Formations (Ashmore and Peddicord, respectively) beneath the Wedron Group Tiskilwa Formation (Delavan Member) at Charleston Quarry.

Figure 16 The Morton Tongue of the Peoria Silt beneath the Delavan Member of the Tiskilwa Formation at the Gardena Section.

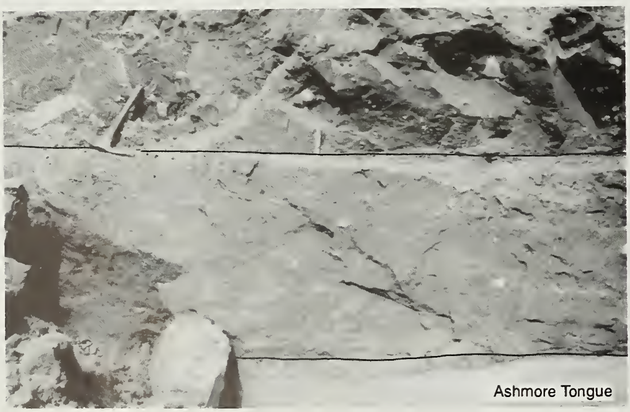


Figure 17 The Ashmore Tongue of the Henry Formation beneath diamictons of the Delavan Member and undivided Tiskilwa Formation at Wedron Quarry pit 6.

Till Member in McLean County and the Glenburn Till Member in Vermilion County (fig. 5). Correlation of the Fairgrange Till Member with the Glenburn Till Member was considered uncertain because of the 38,000 radiocarbon age for the wood in basal Glenburn till.

The Oakland Till Member was also defined by Ford (1973). It was described as a brown to brownish gray, loam to silt loam till relatively abundant in expandable clay minerals, probably as a result of the incorporation of weathered material from the Robein Member of the Roxana Silt. Ford (1973) correlated the Oakland Till Member from its type locality in northeastern Coles County with unit 5 of Kempton et al. (1971) in McLean County and with the basal Wedron Formation till in the Danville area (Johnson et al. 1972).

On the state map of Quaternary deposits (Lineback 1979; fig. 5), the Fairgrange Till Member was mapped as the Decatur Sublobe-equivalent of the Tiskilwa and Delavan Till Members. The Oakland and Glenburn Till Members and the Ashmore Member were not mapped; all are subsurface units. The Glenburn was correlated with the Fairgrange Till Member at the surface (Ford 1973).

In this report, the concept of the Delavan Member is broadened to include the former Oakland, Fairgrange, and Glenburn Till Members. These three members are dropped as formal lithostratigraphic units, although the Oakland is retained as a lower brown, silty facies of the Delavan Till Member or the undivided Tiskilwa Formation. The Oakland facies contains more expandable clay minerals. The Fairgrange Till Member is dropped because (1) no lithologic change has been documented across the Delavan-Fairgrange Till Member boundary as shown on the Quaternary map (Lineback 1979; fig. 5), (2) no significant lithologic difference exists between the diamicton units mapped as the Fairgrange Till Member on either side of the area mapped as the Piatt Till Member, and (3) the Fairgrange Till Member is in the same stratigraphic position as the Delavan Till Member. Thereby, the classification system is simplified, and the Delavan Member, which takes precedence over the more recently defined members, is extended to the Decatur Sublobe area.

Description

The Delavan Member consists of calcareous, brown gray to pink gray or violet gray, loam diamicton that contains lenses of gravel, sand, silt, and clay. Typically, the diamicton oxidizes to brown, tan, yellow brown, or red brown.

Boundaries

Lower boundary: the contact with the Ashmore Tongue (Henry Formation [figs. 12, 15]), the Peddicord Tongue (Equality Formation [figs. 12, 15]), the Morton Tongue (Peoria Silt [fig. 16]), the Robein Member (Roxana Silt [fig. 14]), or older units. Upper boundary: the contact with the Piatt Member (Tiskilwa Formation), the undivided Tiskilwa Formation (fig. 17), the Batestown Member (Lemont Formation), upper tongues of the Peoria Silt and the Henry and Equality Formations, or other surficial units.

Differentiation from other units

The Delavan Member is readily distinguishable from the underlying sorted sediment of the Morton, Ashmore, and Peddicord Tongues, and the Robein Member. Although the Oakland facies of the Delavan Member and the undivided Tiskilwa Formation may be similar mineralogically and texturally to the Robein Member, the Oakland facies has a different structure and does not contain a weathering profile. In portions of the Peoria and Decatur Sublobe areas, diamicton lithology changes laterally along moraines, and for this reason determining the upper boundary of the Delavan is problematic.

Kempton et al. (1971) mapped the distribution of till units in part of the Peoria Sublobe area on the basis of subsurface data, including color, clast lithology, and grain-size and clay-mineral analyses. They showed two families of tills and multiple till units, which they attributed to glacial overriding during successive events. Kempton et al. (1971) also recognized lateral and vertical variations in diamicton color and called for glacial incorporation of older units and shear stacking as a mechanism of moraine building. They concluded that the principal moraines were, in some cases, a composite of two or more till units and the surface till represented a veneer over older till units. In the area near Bloomington, their mapping suggested that the eastern portions of the LeRoy, Shirley, and Bloomington Moraines contain the younger Batestown Member of the Lemont Formation at the surface. Alternatively, some of the lateral and vertical changes in diamicton lithology may reflect facies changes within the same till unit. For this study, we chose the latter interpretation and use a vertical boundary at the front of the Bloomington Morainic System to separate the Delavan Member from the overlying undivided Tiskilwa Formation (fig. 13). Thus, the surface diamicton in the Shirley and LeRoy Moraines in the eastern part of the Peoria Sublobe area would be mapped as a facies of the Delavan that is siltier and more illitic than type Delavan. The diamicton of the Bloomington Morainic System would be mapped as a facies of the undivided Tiskilwa Formation that is grayer and finer grained than type Tiskilwa.

In the southern and western parts of the Decatur Sublobe area, the upper contact of the Delavan Member with the Piatt Member locally appears conformable and gradational over about a 0.5-meter (1.6 ft) zone; farther north in the up-ice direction, the boundary is lithologically distinct and sometimes marked by a striated clast pavement and/or sorted sediment. The western boundary of the Piatt Member (fig. 12) is taken from Lineback (1979; fig. 5). In the southeastern portion of the Decatur Sublobe area, lithologic distinction between the Delavan and Piatt Members (Tiskilwa Formation) and the Batestown Member (Lemont Formation) is difficult; therefore, for mapping and nomenclatural purposes, a vertical boundary at the front of the Cerro Gordo Moraine in Coles County is used to separate the Delavan and Piatt Members (fig. 13).

Regional extent and thickness

The Delavan Member forms a wedge-shaped deposit that pinches out beneath the undivided Tiskilwa Formation in the Harvard, Princeton, and the Peoria Sublobe areas and beneath the Piatt Member in the Decatur Sublobe area. It occurs at the surface in part of the Peoria and Decatur Sublobe areas (fig. 13). In thickness the Delavan Member varies from more than 60 meters (197 ft) in the Shelbyville Morainic System in the Peoria Sublobe area (Willman and Frye 1970) to less than 1 meter (3.3 ft) beneath the undivided Tiskilwa Formation in the northern part of the area. Ford (1973) reported an average thickness (Fairgrange Till Member) of 12 to 18 meters (39–59 ft) in Coles County in the Decatur Sublobe area.

Origin

Where it occurs at the surface in the Peoria and Decatur Sublobe areas, the Delavan Member is interpreted to be till and ice-marginal, redeposited sediment; its composition probably reflects predominantly a local source of glacial debris eroded from older drift and bedrock. In the area where it is buried beneath the undivided Tiskilwa Formation or the Piatt Member, the Delavan Member may constitute a lower, more locally derived till unit in the glacigenic sequence (Johnson and Hansel 1990).

Age and correlation
The Delavan Member was deposited during the early part of the Marengo Phase of the Michigan Subepisode in the Harvard and Princeton Sublobe areas and during the Shelby Phase in the Peoria and Decatur Sublobe areas, probably between about 26,000 and 18,500 radiocarbon years ago (Hansel and Johnson 1992; fig. 10). It likely correlates with a basal grayer facies of the undivided Tiskilwa Formation in some areas of Illinois.

Piatt Member

Status
Reclassified unit. Name changed to the Piatt Member, and unit classified as part of the Tiskilwa Formation. Formerly classified as the Piatt Till Member of the Wedron Formation (Wickham 1979a).

Source of name Piatt, a county in east-central Illinois.

Original name Piatt Till Member (Wickham 1979a).

Type section Mahomet Interstate 74 Bridge Section along the Sangamon River. Overgrown and poorly exposed.

Principal reference sections
Mahomet North Section; good for lower boundary and lithology. Core 4943; good for lithology and contacts. Wedron Section; good for lithology and contacts.

Definition
The Piatt Member is the upper gray, loam diamicton facies of the Tiskilwa Formation. It occurs above part of the Delavan Member in the Decatur Sublobe area and locally above the undivided Tiskilwa Formation elsewhere. The Piatt Member sometimes has a pink or violet cast and oxidizes to light brown or slightly orange.

Background
The Piatt Till Member of the Wedron Formation was defined by Wickham (1979a) in Champaign County. It was described as sandier and more illitic than the underlying Fairgrange Member of the Wedron Formation, which is classified as the Delavan Member of the Tiskilwa Formation in this report. The Piatt Till Member was previously identified as unit 3 in McLean County by Kempton et al. (1971), an unnamed till in Coles County by Ford (1973), and an unnamed sandy till in the northern portions of De Witt and Piatt Counties by Johnson (1976). The Piatt Till Member was mapped as the surface till in Piatt, Moultrie, western Champaign, western Douglas, northeastern Shelby, eastern Macon, eastern De Witt, and southeastern McLean Counties on the state Quaternary map (Lineback 1979; fig. 5). Although similar to diamicton of the overlying Batestown Till Member described by Johnson et al. (1971b) in the Danville area, diamicton of the Piatt Till Member generally contains more sand, has less illite in the clay-size fraction, and sometimes exhibits a pink or violet cast (Wickham 1979a).

Because of its similarity to the Batestown Till Member, the Piatt Till Member was grouped by Johnson (1976) and Lineback (1979) with the middle, medium textured tills of the Wedron Formation. In this report, however, the Piatt Member is classified with the group of medium textured diamicton units included in the Tiskilwa Formation (fig. 7). Like the Delavan Member, the Piatt Member appears to be a grayer, lithologic variant of type-Tiskilwa diamicton, but it still contains some of the red distinctive of the Tiskilwa Formation. It also has lateral continuity with the other portions of the Tiskilwa Formation around the Lake Michigan Lobe area (fig. 13). The Delavan-Piatt Member contact in places appears to be conformable and gradational (i. e., the two members are part of the same glacigenic sequence), suggesting a change in source during the glaciation. As discussed in the introduction, wherever possible we have attempted to place stratigraphic boundaries between formations where lithologic changes correspond with those separating glacigenic sequences.

Description
The Piatt Member consists of gray, loam diamicton containing lenses of sorted sediment. It sometimes has a pink or violet cast and oxidizes to brown, yellow brown, or orange brown, depending on its original color. Diamicton texture may vary, especially near the surface, where locally it is interbedded with stratified sediment.

Boundaries
Lower boundary: the contact with the Delavan Member or the undivided Tiskilwa Formation. Upper boundary: the contact with the Batestown Member (Lemont Formation), upper tongues of the Peoria Silt and the Henry and Equality Formations, or postglacial units.

Differentiation from other units
Diamicton of the Piatt Member is sandier, more illitic, and grayer than that of the underlying Delavan Member, but the contact between these members, especially in the Piatt Member's southern area of occurrence, is often conformable and gradational over about a 0.5-meter zone and thus difficult to delineate in the field. Arbitrary vertical boundaries may be necessary in these areas to laterally separate the Piatt and Delavan Members (see Delavan discussion). Diamicton of the Piatt Member sometimes is difficult to differentiate from that of the overlying Batestown Member, but generally it is both less silty and less illitic. It sometimes exhibits a pink or violet cast and oxidizes to a slightly orange, whereas diamicton of the Batestown Member is grayer and more likely to weather to olive brown. For mapping purposes, a vertical boundary at the Champaign, Pesotum, and Arcola Moraines is recommended (fig. 13).

Regional extent and thickness
The Piatt Member forms an upper wedge-shaped deposit over part of the Delavan Member in the Decatur Sublobe area, where it pinches out beneath the Batestown Member to the northeast (fig. 13). The southwestern front of the deposit follows a distinct protrusion of the Shelbyville Moraine to the southwest. The Piatt Member is up to about 20 meters (66 ft) thick in some parts of Champaign County (as shown in Wickham 1979a).

Origin

The Piatt Member consists of till and ice-marginal, redeposited sediment. Locally, it appears to be part of the same glacigenic sequence as the Delavan Member; in these places a conformable contact between the Piatt and Delavan Members suggests that the two tills were deposited during a single glacial event.

Age and correlation

The Piatt Member was deposited during the Shelby Phase of the Michigan Subepisode, probably between about 19,000 and 18,500 radiocarbon years ago (Hansel and Johnson 1992; fig. 10). It likely correlates with the upper grayer facies of the undivided Tiskilwa Formation in some areas of Illinois.

Lemont Formation

Status

Revised unit. Elevated to formation rank; includes the Haeger Member as the uppermost unit; lower boundary extended to include the Batestown and Yorkville Members. Named the Lemont drift in 1939 and defined as a lithostratigraphic unit by Bretz (1955). Retained, but as an informal unit, in Willman and Frye (1970). Correlated with the Haeger Till Member of the Wedron Formation and recommended as a unit of formation rank by Johnson and Hansel (1989).

Source of name Lemont, a village along the south side of the Des Plaines Valley in Cook County.

Original name Lemont drift (Bretz 1939).

Type section Lemont Section, an abandoned quarry about 1 mile (1.6 km) west of Lemont; good for lithology and upper boundary of the undivided Lemont Formation (fig. 18).

Principal reference sections

Wedron Section (fig. 12); good for lower contact and lithology of the Batestown Member. Higginsville Section (fig. 14); good for lower contact and lithology of the Batestown and Yorkville Members. Land and Lakes Landfill Section; good for lithology of the undivided Lemont Formation and upper contact. Beverly Sand and Gravel Pit (fig. 19); good for lithology of the Haeger Member.

Definition

The Lemont Formation of the Wedron Group is the succession of fine to coarse textured, gray diamicton units that overlies the Tiskilwa Formation and underlies the Wadsworth Formation. Three members, each part of different glacigenic sequences, have been differentiated (fig. 7): a lower member of silt loam to loam diamicton (Batestown Member), a middle member of silty clay to silty clay loam diamicton (Yorkville Member), and an upper member of gravelly, sandy loam diamicton (Haeger Member). In the type area southwest of Chicago, the Lemont Formation is not subdivided. It consists of gravelly silt loam to loam diamicton (fig. 20), much of which is derived from the local Silurian dolomite; the uppermost glacigenic sequence and in places parts of lower glacigenic sequences are represented. The Lemont Formation is not subdivided in most of the Princeton Sublobe area (fig. 13a, Lee, De Kalb, Kane, Bureau, La Salle, and Kendall Counties), where diamicton units that are laterally contiguous and likely time equivalent with the Batestown and Yorkville Members are commonly coarser in grain size.

Background

The Lemont drift was recognized early (Bretz 1939) and described in detail (Bretz 1955) as a distinct lithostratigraphic unit that crops out along the Des Plaines and Sag Channels southwest of the Chicago Metropolitan Area. Bretz (1955) named the Lemont a drift rather than a till because of the complex association of abundant washed sediment with till in the unit. Bretz recognized that the

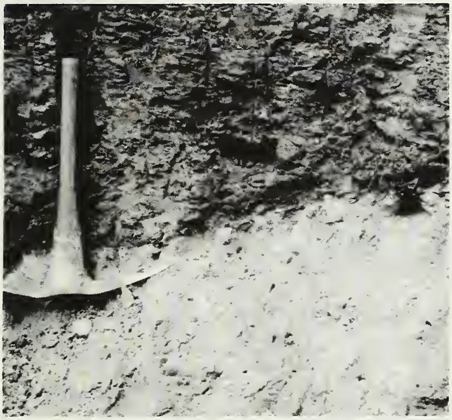


Figure 18 Clayey diamicton of the Wadsworth Formation above oxidized, silty, dolomitic diamicton of the undivided Lemont Formation at the Lemont Section.

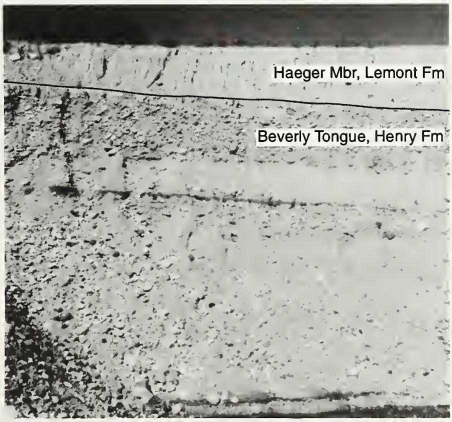


Figure 19 Diamicton (subglacial till) of the Haeger Member of the Lemont Formation overlies the proglacial (ice proximal) sand and gravel of the Beverly Tongue of the Henry Formation at the Beverly Sand and Gravel Pit Section.

Lemont drift was older than the surficial clayey till in the Valparaiso, Tinley, and Lake Border Moraines in the Chicago region, but he was uncertain of its age and relationship to older units in Illinois.

Horberg and Potter (1955) described buried weathered zones in stratified sediment in the upper part of the Lemont drift. Because of the thickness (about 2 m; 6.6 ft) and character of the weathered zone at the Worth Section southwest of Chicago, they interpreted it as fossil soil correlative with the last interglacial paleosol, the Sangamon soil. Thus, they interpreted the Lemont drift to be Illinoian age. Alternatively, Frye and Willman (1960) suggested the weathering profile might correlate instead with the last interstadial paleosol, the Farmdale soil, and therefore concluded the Lemont drift could be Altonian age. Probably because of the uncertainty about its age, Willman and Frye (1970) did not give the Lemont drift formal status when they established a lithostratigraphic classification of Pleistocene units in Illinois. They suggested the Lemont drift, which they retained as an informal unit, could be Illinoian, Altonian, or Woodfordian age. Willman and Frye (1970) observed the Lemont drift was lithologically most like the Haeger Till Member of the Wedron Formation. Bogner (1973) concluded the weathered zones in the Lemont drift, which also occur in the Wadsworth Till Member, could be traced upward along joints to the modern soil. Thus, she concluded the Lemont could be Woodfordian. She correlated the Lemont drift with the Malden Till Member of the Wedron Formation, as had Kempton (Willman and Frye 1970) and Landon and Kempton (1971).

Figure 20 Unoxidized, silty, dolomitic diamicton of the undivided Lemont Formation exposed in O'Hare reservoir excavation.

Johnson and Hansel (1985, 1989) and Hansel and Johnson (1986) agreed with Bogner's (1973) interpretation of the weathered zones within the Lemont drift as representative of an extension of the modern soil profile along joints to form secondary zones of clay accumulation below the main part of the B horizon (fig. 21). Such zones, which are leached of carbonates, can develop in stratified sediment, particularly in coarse, permeable sediment that is calcareous. Some leached zones (*beta* B horizons) form immediately below the main B horizon, whereas others (*gamma* B horizons) form below a calcareous layer but are connected by joints to the overlying main B horizon. Johnson and Hansel (1989) also agreed with Bogner's (1973) interpretation that the Lemont drift was part of the Wedron Formation, but on the basis of lithostratigraphy and sedimentological sequences in and westward of the Valparaiso Moraine, they correlated the Lemont drift with the Haeger rather than with the Malden Till Member. In 1989, Johnson and Hansel identified two glacigenic sequences within the Lemont drift in the type locality; they concluded the tongue of lacustrine sediment between the tills of the two sequences represented the first phase of ancestral Lake Michigan during the last deglaciation. They correlated the upper glacigenic sequence with the Haeger Till Member, which crops out in McHenry County, and suggested the lower sequence, although lithologically similar to the Lemont drift, may be time correlative with either the Malden or Yorkville Till Members of the Wedron

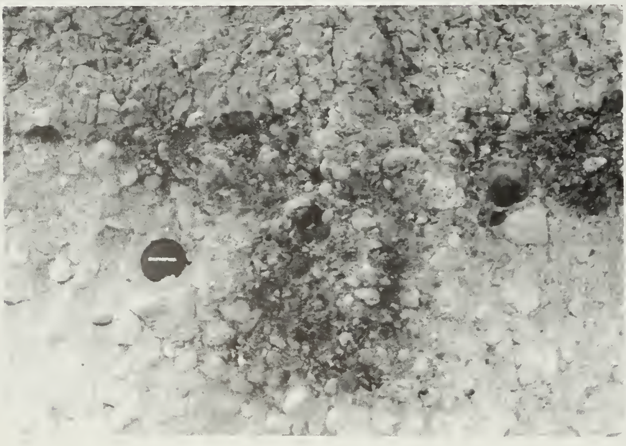


Figure 21 A *gamma* B horizon developed in the upper part of a tongue of the Henry Formation, which occurs beneath jointed, calcareous diamicton of the Wadsworth Formation and above diamicton of the Lemont Formation. The *gamma* B horizon represents an extension of the modern soil profile along joints to form a secondary zone of clay accumulation below the main B horizon.

Figure 22 Sediment-flow diamicton of the undivided Lemont Formation above a coarsening-upward sand and gravel tongue of the Henry Formation. The unnamed tongue is correlative with the Beverly Tongue, which occurs beneath the Haeger Member of the Lemont Formation.

Formation. Engineers in the Chicago area have commonly referred to the Lemont drift as the "Chicago hardpan" (DeLeuw-Novick 1975). Agreeing with Bretz (1955) that the Lemont drift constitutes an important lithostratigraphic unit in northeastern Illinois, as well as a unit of regional significance, Johnson and Hansel (1989) recommended the name Lemont be retained for a formation if the Wedron Formation were raised to group rank.

The Lemont Formation as proposed herein contains multiple diamicton units that vary in texture from silty clay to sandy loam. The diamicton units are interfingered with tongues of the Henry and Equality Formations of the Mason Group; they are part of several glacigenic sequences that occur stratigraphically between the Tiskilwa and Wadsworth Formations. Southwest of Chicago in the type area of the Lemont drift, the Lemont Formation is left undivided and consists of multiple diamicton units that are interfingered with tongues of sorted sediment of the Mason Group. Diamicton in the undivided Lemont Formation is predominantly gravelly silt loam that, although light gray in the subsurface, generally oxidizes to yellow brown in exposures (fig. 18). The diamicton contains lenses of sorted sediment, predominantly silt, sand, and gravel. Away from the type area, lateral facies changes are interpreted to occur between the locally derived dolomitic silt loam to loam diamicton of the undivided Lemont Formation and the (1) sandy loam diamicton of the Haeger Member, (2) silty clay diamicton of the Yorkville Member, and (3) silt loam diamicton of the Batestown Member (fig. 7). Diamicton of the former Malden Till Member is included in the Batestown Member (formerly, the Batestown Till Member; Johnson et al. 1971b) or the Yorkville Member (formerly, the Yorkville Till Member; Willman and Frye 1970). Diamicton of the former Snider Till Member (Johnson et al. 1971b) also is included in the Yorkville Member.

Description
The Lemont Formation consists of calcareous, gray, fine to coarse textured (silty clay to sandy loam) diamicton units that contain lenses of gravel, sand, silt, and clay. The characterizing element in the matrix texture of Lemont diamicton is silt, which generally makes up about 30% to more than 50% of the matrix. Typically, the diamicton of the Lemont Formation oxidizes to brown, olive brown, or yellow brown. A coarsening-upward sand and gravel sequence (Beverly Tongue of Henry Formation) was observed beneath the Haeger Member and beneath the correlative uppermost diamicton unit of the undivided Lemont Formation in its type area (fig. 22).

Boundaries
Lower boundary: the contact with tongues of the Henry (fig. 22) and Equality Formations, the Tiskilwa Formation, older units, or bedrock. Upper boundary: the contact with the Wadsworth Formation (fig. 18), upper tongues of the Peoria Silt and Henry and Equality Formations, or postglacial units.

Differentiation from other units
Diamicton of the Lemont Formation is generally grayer and more illitic than that of the underlying Tiskilwa Formation. It commonly oxidizes to olive brown or yellow brown, whereas the diamicton of the Tiskilwa Formation oxidizes to brown or red brown. Its texture varies more than that of the overlying silty clay diamicton of the Wadsworth Formation. In the Decatur Sublobe area, diamicton of the Batestown Member generally contains more silt and less sand than that of the underlying Piatt Member; where this differentiation is indistinct, the Champaign-Pesotum-Arcola moraine front is used as a vertical boundary between these members (fig. 13). In the southern part of the Peoria Sublobe area where lateral facies along moraines occur, a vertical boundary at the front of the Normal Moraine is used to separate the Lemont Formation from the underlying Tiskilwa Formation. The silty clay diamicton of the Yorkville Member is very similar to that of the Wadsworth Formation; where they are juxtaposed, the West Chicago-Wilton Center moraine front is used as a vertical boundary between the two units (fig. 13). In the Harvard Sublobe area, the Haeger Member generally is readily distinguishable from the Tiskilwa and Wadsworth Formations. Locally, diamicton of the Yorkville and Haeger Members may be red gray or red brown and the uncharac-

teristic redder hues and lithology have been interpreted to reflect incorporation of diamicton of the Tiskilwa Formation (Wickham et al. 1988).

Regional extent and thickness
The Lemont Formation consists of several wedge-shaped diamicton units that overlap the Tiskilwa Formation and pinch out beneath the Wadsworth Formation. The Lemont Formation is up to about 60 meters (197 ft) thick in some moraines and forms the surface unit in more than half the area of the Wedron Group in Illinois (fig. 13). It is volumetrically, however, not as large as the Tiskilwa Formation, which is much thicker and more extensive in the subsurface.

Origin
The Lemont Formation is interpreted to represent the subglacial and ice-marginal facies of several offlapping glacigenic sequences. Diamicton of the Lemont Formation is more illitic and contains fewer far-travelled crystalline erratics than that of the Tiskilwa Formation. The predominant clast lithologies consist of Paleozoic shale and carbonate. The composition of the Lemont Formation indicates predominantly a Lake Michigan basin, northern Illinois, and southeastern Wisconsin source. We attribute the fine grained matrix of Yorkville diamicton in part to reflect incorporation of proglacial lacustrine sediment that accumulated between end moraines and the glacier as the ice margin melted back and readvanced during the late Putnam and early Livingston Phases (fig. 10).

Age and correlation
The Lemont Formation was deposited during the Shelby (in the Arcola Moraine, eastern part of the Decatur Sublobe area), Putnam, Livingston, and Woodstock Phases of the Michigan Subepisode, probably between about 18,500 and 15,500 radiocarbon years ago (Hansel and Johnson 1992). Each phase represents the interval of a readvance and subsequent melting back of the ice margin (fig. 10). Fluctuations were 50 kilometers (31 mi) or more. The Lemont Formation correlates in part with the New Berlin and Horicon Members (Holy Hill Formation) of Wisconsin, the Batestown and Snider Tills of Indiana, and possibly the Ganges till of Michigan (fig. 11).

Batestown Member

Status
Reclassified and redescribed unit. Name changed to Batestown Member of the Lemont Formation, and unit description broadened to include lithologically similar and stratigraphically equivalent diamicton in the lower part of the former Malden Till Member of the Peoria and Princeton Sublobe areas. Formerly classified as the Batestown Till Member of the Wedron Formation (Johnson et al. 1971b).

Source of name Batestown, a village in Vermilion County.

Original name Batestown Till Member (Johnson et al. 1971b).

Type section Emerald Pond Section near Danville in Vermilion County; good for contacts and lithology, but deteriorating.

Principal reference sections
Higginsville Section (fig. 14); good for contacts and lithology. Wedron Section (fig. 12); good for contacts and lithology.

Definition
The Batestown Member is the medium textured, lowermost unit of diamicton in the Lemont Formation. Diamicton of the Batestown Member generally consists of dark gray to gray silt loam to loam that oxidizes to brown or olive brown.

Background
The Batestown Till Member of the Wedron Formation was originally defined by Johnson et al. (1971b) and described as a distinct gray till, easily recognized by its texture, structure, and color in the Decatur Sublobe area (Johnson et al. 1971b). They correlated the Batestown Till Member with unit 2 of Kempton et al. (1971) in the McLean County area to the west. McKay (1975) traced the Batestown Till Member westward into the Peoria Sublobe area and concluded it to be equivalent to the lower part of the Malden Till Member (Willman and Frye 1970). On the basis of McKay's study (1975), Johnson (1976) included the Batestown Till Member with the middle, medium textured tills of the Wedron Formation and correlated it with the lower part of the Malden Till Member of northeast and central Illinois (fig. 7). On the 1979 state Quaternary map compiled by Lineback, silty till in the eastern part of the Bloomington, Normal, Eureka, and Fletchers Moraines of the Peoria Sublobe area was mapped as the Batestown Till Member (figs. 5, 13). Similarly, Johnson et al. (1986) mapped the loam till south of the Illiana Morainic System as the Batestown Till Member, and extended the member to include the loam till in the Peoria Sublobe area. They concluded the Decatur Sublobe area (like the Peoria Sublobe area) was inundated by the Lake Michigan Lobe, rather than by a coalesced Huron-Erie Lobe.

In this report, the Batestown Till Member of the Wedron Formation is reclassified the Batestown Member of the Lemont Formation. On the basis of the previous work discussed above and in an attempt to make the classification system simpler by avoiding two names (Malden and Batestown) for the same lithostratigraphic unit in different sublobe areas, the name Batestown Member is the designation for all the gray loam diamicton units of the lower glacigenic sequence(s) of the Lemont Formation in the Decatur and Peoria Sublobe areas and part of the Princeton Sublobe area (figs. 7, 13). The lower, medium textured diamicton units of the former Malden Till Member are classified as the Batestown Member, whereas the upper, finer textured diamicton units of the former Malden Till Member are included in the revised Yorkville Member. Although the term Malden takes precedence over the term Batestown, we choose to use the term Batestown for the member name because the Malden Till Member as defined by Willman and Frye (1970) carries little meaning in regard to lithology. The Malden Till Member included all diamicton units stratigraphically above the Tiskilwa Till Member and beyond the Marseilles Morainic System (Yorkville Till Member). Diamicton texture in these units ranges from very fine to coarse. To avoid such lithic ambiguity, we have elected to reserve the term Batestown Member for the more medium textured diamicton of the lower part of the Lemont Formation; it crops out beyond the margin of the

Arlington, Varna, El Paso, and Newtown Moraines (fig. 13). Locally in the Peoria Sublobe area, particularly at or near the surface, diamicton of the Batestown Member contains more clay than diamicton of type-Batestown. Because we interpret this clayier diamicton to reflect a facies change, it is treated herein as an informal facies of the Batestown Member. Similarly, we interpret lateral variation in diamicton texture along the strike of moraines that extend into the northern part of the Princeton Sublobe area to reflect facies changes, and we do not subdivide the Lemont Formation in that area (fig. 13). This avoids the 45-kilometer (28 mi) offset of member boundaries present on the 1979 state Quaternary map north and south of the Illinois River (fig. 5).

Description

The Batestown Member of the Lemont Formation consists of calcareous, gray, medium textured (loam) diamicton (fig. 23) that contains lenses of gravel, sand, silt, and clay. Typically, it oxidizes to brown, olive brown, or yellow brown. Locally in the Peoria and Decatur Sublobe areas, diamicton of the Batestown Member is finer and texturally similar to diamicton of the Yorkville Member. This finer textured diamicton is retained in the Batestown Member because of lateral continuity, but it should be mapped, where appropriate, as an informal facies.

Boundaries

Lower boundary: the contact with the undivided Tiskilwa Formation (fig. 24), the Delavan or Piatt Members (Tiskilwa Formation; fig. 14), tongues of the Henry and Equality Formations (fig. 25), or older units. Upper boundary: the contact with the Yorkville Member (Lemont Formation; figs. 14, 24), tongues of the Peoria Silt (fig. 12) and the Henry and Equality Formations, or postglacial units.

Differentiation from other units

Diamicton of the Batestown Member is generally distinguishable from the redder, less illitic, and clayier diamicton of the underlying Tiskilwa Formation. In the Peoria Sublobe area, however, a vertical boundary is used at the front of the Normal Moraine because diamicton in the eastern part of the Bloomington Morainic System is similar to that of the Batestown Member (fig. 13). Similarly, in the Decatur Sublobe area a vertical boundary along the Champaign-Pesotum-Arcola moraine front is used for mapping purposes to distinguish diamicton of the Piatt and Delavan Members (Tiskilwa Formation) from that of the Batestown Member. The contact of the Batestown Member with the overlying Yorkville Member is readily distinguishable in the Decatur Sublobe area. It is less clear in the central part of the Peoria Sublobe area where a finer textured facies of the Batestown diamicton occurs. For mapping purposes, a vertical boundary is used at the front of the El Paso Moraine to separate the Yorkville and Batestown Members. West of the St. Charles Moraine in the northern part of the Princeton Sublobe area, the Batestown and Yorkville Members are indistinct, and the Lemont Formation is not subdivided.

Regional extent and thickness

The Batestown Member forms a wedge-shaped deposit that overlaps the Tiskilwa Formation and pinches out beneath the Yorkville Member to the north and east. It crops out in the shape of a crescent, which has a reentrant in the area where the Decatur and Peoria Sublobes met (fig. 13). The Batestown Member is up to about 25 meters (82 ft) thick in some end moraines (see for example, Wickham 1979a).

Origin

The Batestown Member is interpreted to be the subglacial and ice-marginal facies of one or more glacigenic sequences; it consists predominantly of till. Evidence from the Wedron Section and the surrounding region in the area near the Princeton and Peoria Sublobe boundary (Johnson and Hansel 1990, Hansel and Johnson 1992) indicates that deposition of the Batestown Member followed a fairly significant readvance (75 km; 47 mi) of the ice margin. At the Wedron Section, the Batestown Member lithology (medium textured, gray diamicton) suggests a more local source (Illinois and Lake Michigan basin) than does the underlying Tiskilwa Formation lithology. In the area of the Decatur and southern part of the Peoria Sublobes, the lithological change to a more local source likely took place earlier in the glacial history and more gradually. For example, in color, matrix grain size, and clay-mineral composition, diamicton of the Piatt Member of the Tiskilwa Formation is intermediate between diamicton of the Delavan Member of Tiskilwa Formation and that of the

Figure 23 Silt loam diamicton (subglacial till) of the Batestown Member of the Lemont Formation.

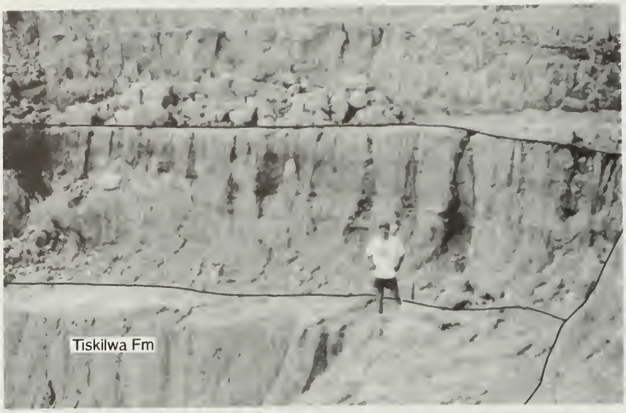


Figure 24 Silty clay diamicton of the Yorkville Member and silt loam diamicton of the Batestown Member (Lemont Formation) overlie clay loam diamicton of the undivided Tiskliwa Formation at Fox River Stone Quarry, St. Charles, Illinois. The diamictons are interpreted to be subglacial tills.

Figure 25 Sorted-sediment tongue of the Equality Formation between diamictons of the Batestown Member of the Lemont Formation and the Piatt Member of the Tiskilwa Formation at Wedron Quarry pit 6.

Batestown Member of the Lemont Formation. Diamicton in the Bloomington Morainic System east of Bloomington, Illinois, classified herein as undivided Tiskilwa Formation, is similar to diamicton of the Batestown Member (fig. 13).

Age and correlation
The Batestown Member was deposited during the later part of the Shelby Phase (central Decatur Sublobe area) and the Putnam Phase of the Michigan Subepisode, probably between about 18,500 and 17,700 radiocarbon years ago (Hansel and Johnson 1992; fig. 10). It correlates with the Batestown Till in Indiana (fig. 11).

Yorkville Member

Status
Reclassified and redescribed unit. Name changed to the Yorkville Member and unit classified as part of the Lemont Formation. Lower boundary extended in the Decatur and Peoria Sublobe areas to include fine grained diamicton units mapped by Lineback (1979) as the Snider and Malden Till Members. Formerly classified as the Yorkville Till Member of the Wedron Formation (Willman and Frye 1970).

Source of name Yorkville, a village in Kendall County.

Original name Yorkville Till Member (Willman and Frye 1970).

Type section Roadcut at the intersection of Illinois Highways 71 and 47; no longer exposed.

Principal reference sections
Higginsville Section (fig. 14); good for lower boundary and lithology. Wedron Section; good for lower boundary (fig. 26). Core 7815; good for lithology.

Definition

The Yorkville Member is the fine grained, middle unit of diamicton in the Lemont Formation. It is generally dark gray, silty clay to silty clay loam diamicton that oxidizes to olive brown.

Background

The Yorkville Till Member of the Wedron Formation was originally defined by Willman and Frye (1970). It was described as a very clayey gray till that commonly exhibits a green cast, and as being slightly darker than other gray tills. Willman and Frye (1970) mapped the Yorkville Till Member in parts of the Harvard (Barlina Moraine), Princeton (St. Charles Moraine), and Peoria (Marseilles, Minooka, and Rockdale Moraines) Sublobe areas (fig. 4). In the Decatur Sublobe area, gray silty clay to silty clay loam diamicton similar to but sandier than type-Yorkville diamicton was defined as the Snider Till Member (Johnson et al. 1971b). McKay (1975) correlated diamicton of the Snider Till Member with diamicton in the El Paso, Minonk, and Strawn Moraines in the Peoria Sublobe area that Willman and Frye (1970) had included in the Malden Till Member. Johnson (1976) included the Snider and Yorkville Till Members in a group of upper, fine textured tills of the Wedron Formation (fig. 7). On the 1979 state Quaternary map (fig. 5), Lineback extended the Snider Till Member into part of the Peoria Sublobe area where Willman and Frye (1970) originally had mapped the Malden Till Member. Later, on the basis of field relationships and statistical treatment of textural and compositional data, Moore (1981) (1) correlated diamicton in the Chatsworth, Ellis, and Paxton Moraines with the Snider Till Member in its type area; (2) reported the Yorkville and Snider were portions of a single lithologic unit; and (3) recommended on the basis of priority that the name Snider be dropped and the name Yorkville be retained for this unit. Killey (1982) identified two distinct clay-mineral zones (the Dwight averaging 76% illite and the lower Yorkville averaging 81% illite) in the area mapped as the Yorkville Till Member in Livingston, Woodford, and Marshall Counties. She attributed the zones to represent separate ice-margin advances. In this report, the Yorkville Till Member of the Wedron Formation is reclassified as the Yorkville Member of the Lemont Formation (fig. 7). The Yorkville Member description is broadened to include fine textured diamicton units (silty clay and silty clay loam) that were (1) left undivided in the Wedron Formation in the Decatur Sublobe area by Willman and Frye (1970) and subsequently classified as the Snider Till Member by Johnson et al. (1971b); (2) mapped as part of the Malden Till Member in the Princeton Sublobe area by Willman and Frye (1970); and (3) mapped as part of the Malden Till Member (Willman and Frye 1970) or a combination of the Malden and Snider Till Members in the Peoria Sublobe area (Lineback 1979).

Description

The Yorkville Member of the Lemont Formation consists of calcareous, gray, fine textured (silty clay to silty clay loam) diamicton that contains lenses of gravel, sand, silt, and clay. Typically, it oxidizes to olive brown. Paleozoic shale and dolomite are common clast lithologies. As noted by Willman and Frye (1970), the weathered surface of Yorkville diamicton commonly contains a concentration of small dolomitic pebbles, giving it the appearance of gravel.

Boundaries

Lower boundary: the contact with the Batestown Member (figs. 14, 24), the Tiskilwa Formation, tongues of the Henry

Figure 26 Modern soil developed in diamicton of the Yorkville Member of the Lemont Formation above a sand and gravel tongue of the Henry Formation at Wedron Quarry pit 1.

(fig. 26) and Equality Formations, older units, or bedrock. Upper boundary: the contact with the Beverly Tongue of the Henry Formation, the Haeger Member, the undivided Lemont Formation, the Trafalgar Formation, the Wadsworth Formation, tongues of the Equality Formation, upper tongues of the Peoria Silt and Henry Formation (fig. 27), or postglacial units.

Differentiation from other units

The Yorkville Member diamicton generally contains more clay than the underlying Batestown Member diamicton. However, where the Batestown Member diamicton is finer textured than type-Batestown diamicton, differentiation between the two units is more difficult, and locally a vertical boundary is needed to distinguish them for mapping purposes. For example, in the Peoria Sublobe area, a vertical boundary is used at the front of the El Paso Moraine to separate the silty clay diamicton of the Yorkville Member from diamicton beyond the moraine that has a similar texture, but which we consider to be a fine grained facies of the Batestown Member (fig. 13). In vertical sequence, sorted sediment of the Equality and Henry Formations is often present between diamicton units of the Batestown and Yorkville Members and helps to differentiate the two units. Diamicton of the Yorkville Member is much finer than the coarse textured diamicton of the Haeger Member in the area of the Harvard Sublobe. Stratified sand and gravel of the Beverly Tongue of the Henry Formation is common beneath diamicton of the Haeger Member and correlative diamicton of the undivided Lemont Formation. The upper boundary of the Yorkville Member is more problematic in the Joliet Sublobe area where fine textured diamicton of the Wadsworth Formation may be in contact with that of the Yorkville Member. In that area, a vertical boundary at the West Chicago-Wilton Center moraine front is used to demarcate the unit boundary (fig. 13). The latter ice-margin position coincides approximately with the erosional margin of Silurian bedrock, where the Yorkville Member pinches out or is in facies relationship with the basal part of the undivided Lemont Formation. Locally, diamicton of the Yorkville Member may be red gray or red brown; the uncharacteristic redder

Figure 27 Upper tongues of the Peoria Silt and Henry Formation above diamictons of the Yorkville and Batestown Members of the Lemont Formation and the undivided Tiskilwa Formation, which overlie the Elwood Dolomite (Silurian) at the Fox River Stone Company Quarry, St. Charles, Illinois.

hues and lithology have been interpreted to reflect incorporation of diamicton of the Tiskilwa Formation (Wickham et al. 1988).

Regional extent and thickness
The Yorkville Member forms a wedge-shaped diamicton unit that overlaps the Batestown Member, the Tiskilwa Formation, older units, or bedrock. Although the Yorkville Member crops out over a large area, it pinches out for a very short distance north and east beneath the Haeger Member in the Harvard Sublobe area and the undivided Lemont Formation or the Wadsworth Formation in the Joliet Sublobe area (fig. 13). The Yorkville Member is up to 60 meters (197 ft) thick in some parts of the Marseilles Morainic System (Willman and Payne 1942).

Origin
The Yorkville Member is interpreted to represent the subglacial and ice-marginal facies of multiple offlapping glacigenic sequences; it consists predominantly of till, but may also contain subaqueous debris flow and lacustrine sediment. One or more proglacial lakes likely existed between the moraines to the west and the Lake Michigan Lobe glacier, which may have wasted back to a position near the Silurian-Ordovician boundary before readvancing. The fine textured lithology of the Yorkville Member is consistent with a lacustrine and shale source.

Age and correlation
The Yorkville Member was deposited during the Livingston Phase of the Michigan Subepisode, probably between about 17,700 and 16,200 radiocarbon years ago (Hansel and Johnson 1992) (fig. 10). It correlates with fine textured diamicton included in the Snider Till south of the Kankakee River Valley in Indiana (fig. 11).

Haeger Member

Status
Reclassified unit. Name changed to the Haeger Member and unit classified as part of the Lemont Formation. Formerly classified as the Haeger Till Member of the Wedron Formation.

Source of name Haegers Bend, a village along the Fox River in McHenry County.

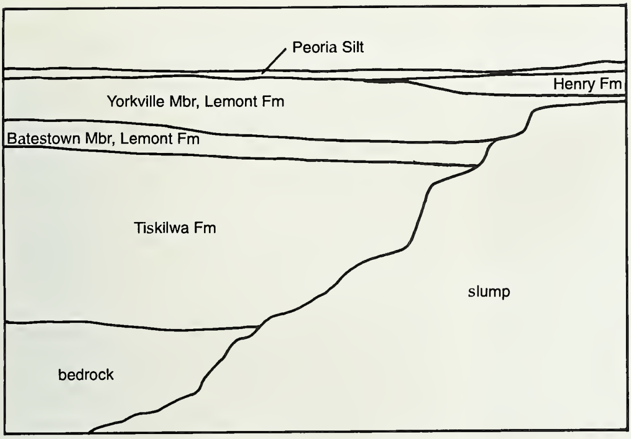
Original name Haeger Till Member (Willman and Frye 1970).

Type section Roadcuts along the Algonquin-Cary Road, 0.5 mile (0.8 km) northwest of Haegers Bend; no longer exposed.

Principal reference sections
Beverly Sand and Gravel Pit Section (fig. 19); good for lithology and lower contact with the Beverly Tongue of the Henry Formation (contact with underlying Yorkville Member confirmed from dredging in base of pit).

Definition
The Haeger Member is the coarse grained, uppermost unit of diamicton in the Lemont Formation. The Haeger Member diamicton consists of gravelly, sandy loam that is typically oxidized to yellow brown in surface exposures, but it is light gray to gray in the subsurface. The Haeger Member is commonly underlain by a proglacial, coarsening-upward sand and gravel sequence (Fraser and Cobb 1982), which is classified herein as the Beverly Tongue of the Henry Formation (fig. 19). In the Joliet Sublobe area, the Haeger Member is overlain by the Wadsworth Formation.

Background
The Haeger Till Member of the Wedron Formation was originally defined by Willman and Frye (1970) and described as a silty, sandy, gravelly till interstratified with sand and gravel outwash. It was mapped as a surface unit in the Harvard Sublobe area. Although they defined the upper boundary of the Haeger Till Member as the contact with the Wadsworth Till Member (fig. 7), Willman and Frye (1970) expressed some uncertainty as to whether sandy



Haeger till graded southward into clayey Wadsworth till along the West Chicago Moraine or, instead, was overlapped by Wadsworth till (fig. 13). The latter interpretation was accepted by Johnson et al. (1985b) and Kempton et al. (1987b), who recognized the Haeger Till Member in the subsurface beneath the Wadsworth Till Member east and south in Lake and Cook Counties. Johnson et al. (1985b), Hansel and Johnson (1986, 1987), and Johnson and Hansel (1989) correlated the Haeger Member with the Lemont drift (Bretz 1939, 1955), which crops out along the Des Plaines Channel southwest of Chicago. In the Joliet Sublobe area where the Wadsworth Till Member is the surface drift, Johnson et al. (1985b) and Hansel and Johnson (1987) concluded the West Chicago Moraine is a superposed feature that reflects in part a buried moraine that formed at the Haeger-Lemont ice margin. In that area, the moraine contains Haeger-Lemont drift overlain by Wadsworth diamicton and represents two distinct glacial events. Hansel et al. (1985a) proposed a new name, Woodstock Moraine, be used for the part of the moraine that represents the Haeger ice-margin position in the area of the Harvard Sublobe (fig. 13). They suggested the name West Chicago Moraine be applied for only that part of the moraine in the Joliet Sublobe area where the Wadsworth Till Member is at the surface.

The Haeger Till Member of the Wedron Formation (Willman and Frye 1970) is herein classified as the Haeger Member of the Lemont Formation. The Haeger Member consists of a sandy loam diamicton unit that often contains lenses and beds of sorted sediment in its upper part. Typically, it is underlain by a coarsening-upward stratified facies that sometimes contains beds and tongues of diamicton near the top (see for example, Fraser and Cobb 1982, Johnson et al. 1985b, Hansel and Johnson 1986, Johnson and Hansel 1989, and Schneider 1983). In this report, the coarsening-upward sand and gravel is classified as the Beverly Tongue of the Henry Formation, and it is locally underlain by a tongue of the Equality Formation (Fraser and Cobb 1982). In McHenry County, the diamicton facies (Haeger Member) is often missing, probably due to subsequent erosion, and the Henry Formation is the surficial unit.

Description

The Haeger Member of the Lemont Formation consists of calcareous, light gray to gray, coarse textured (sandy loam) gravelly diamicton that contains lenses of sand, gravel, silt, and clay. The Beverly Tongue of the Henry Formation, which consists of a coarsening-upward succession of stratified sediment that is similar in lithology to Haeger diamicton, is common beneath the diamicton unit. Typically, the Haeger Member is oxidized to yellow brown. Paleozoic dolomite is the dominant clast lithology.

Boundaries

Lower boundary: the contact with the Yorkville Member of the Lemont Formation, the Tiskilwa Formation, the Beverly Tongue of the Henry Formation (fig. 19), or older units. Upper boundary: the contact with the Wadsworth Formation, upper tongues of the Peoria Silt and the Henry and Equality Formations, or postglacial units.

Differentiation from other units

Haeger diamicton in McHenry County is generally readily distinguishable because it is distinctly coarser grained than other units of the Wedron Group and it is oxidized to yellow brown. It is most similar to diamicton of the undivided Lemont Formation, although it is sandier and less illitic than type-Lemont diamicton southwest of Chicago. A lateral change in texture and clay-mineral composition appears to occur between the type areas of the two units (Johnson et al. 1985b, Johnson and Hansel 1989). Locally, diamicton of the Tiskilwa Formation and that of the lower part of the Haeger Member may be similar as a result of entrainment of red Tiskilwa diamicton during the Haeger advance. Schneider (1983) noted that locally the Haeger-equivalent New Berlin till is redder in its lower part in southeastern Wisconsin.

Regional extent and thickness

The Haeger Member forms a wedge-shaped deposit that overlaps the Beverly Tongue, the Yorkville Member, or the Tiskilwa Formation and pinches out to the north and east beneath the Wadsworth Formation. The surface extent of the Haeger Member is limited to the Harvard Sublobe area;

it is the surface diamicton over about half of McHenry County and very minor parts of adjacent Lake, Kane, and Cook Counties (fig. 13). In Wisconsin, the equivalent New Berlin Member of the Holy Hill Formation is mapped at the surface in the Delavan Sublobe area (Schneider 1983, Mickelson and Syverson, in press; fig. 11). Geophysical evidence for a gravelly diamicton underlying the Wadsworth Formation beneath southwestern Lake Michigan was recognized by Welkie and Meyer (1983) and Foster and Colman (1991), and correlation of this gravelly diamicton with the Haeger Member was suggested. The Haeger Member is generally less than 10 meters (33 ft) thick and thins to less than 1 meter (3.3 ft) in parts of northeastern Illinois and southeastern Wisconsin (Fricke and Johnson 1983).

Origin

The Haeger Member is interpreted to be the subglacial and ice-marginal facies of a classic glacigenic sequence; it is predominantly till and reworked supraglacial and ice-marginal sediment. Where complete, the full sequence consists of proglacial lacustrine and/or fluvial sediment (a coarsening-upward sequence of silt, sand, and gravel) interbedded with deposits of ice-marginal debris flows near the top and overlain by till, supraglacial redeposited sediment, and proglacial fluvial and lacustrine deposits. The hummocky topography of the Woodstock and Valparaiso Moraines suggests thickened debris-rich ice accumulated in the supraglacial position. This occurrence was probably the result of compressive flow and overriding of slow-moving or stagnant ice, dammed by older drift and the bedrock divide. This action produced a predominance of ice-marginal sedimentation as the Lemont-Haeger-New Berlin ice melted (Hansel and Johnson 1987). Clast and matrix lithologies are consistent with a fairly local source for much of the unit (i. e., the Paleozoic bedrock along the western flanks of the Lake Michigan basin and older Quaternary units in southeastern Wisconsin and northeastern Illinois), although crystalline erratics are not uncommon.

Age and correlation

The Haeger Member was deposited during the Woodstock Phase of the Michigan Subepisode, probably between about 16,200 and 15,500 radiocarbon years ago (Hansel and Johnson 1992; fig. 10). It correlates with the New Berlin Member of the Holy Hill Formation of Wisconsin and possibly the Ganges till of Michigan (fig. 11).

Wadsworth Formation

Status

Revised unit. Elevated in rank to a formation of the Wedron Group, and name changed to the Wadsworth Formation. Formerly classified as the Wadsworth Till Member of the Wedron Formation (Willman and Frye 1970).

Source of name Wadsworth, a village in Lake County.

Original name Wadsworth Till Member (Willman and Frye 1970).

Type section Roadcut at the intersection of Illinois Highway 131 and Wadsworth Road, 2 miles east of Wadsworth; no longer exposed.

Principal reference sections

Fort Sheridan Lake Bluff Section; good for lithology. Land and Lakes Landfill Section; good for lithology and lower contact. Cedarburg Lake Bluff Section in Wisconsin; good for lithology of the Wadsworth-equivalent Oak Creek Formation and upper contact.

Definition

The Wadsworth Formation of the Wedron Group is a succession of fine grained, gray diamicton units that overlies the Lemont Formation and underlies the Kewaunee Formation.

Background

The Wadsworth Till Member of the Wedron Formation was defined by Willman and Frye (1970) and described as consisting of the clay-rich gray tills of the Valparaiso, Tinley, and Lake Border Moraines. Slight differences in texture and clay-mineral composition of Wadsworth diamicton were reported from the different moraines by Willman and Frye (1970) and Hansel (1983), but the unit was not formally subdivided. Subsurface studies also reported subunits on the basis engineering and lithological properties (Bogner 1975, Killey and Trask 1994). The Wadsworth Till Member was mapped beneath Lake Michigan in the southern part of the lake basin (Lineback et al. 1974, Wickham et al. 1978, Colman et al. 1989, Colman and Foster 1990).

The Wadsworth Till Member of the Wedron Formation (Willman and Frye 1970) is herein elevated in rank to the Wadsworth Formation of the Wedron Group. The Wadsworth Formation constitutes a distinct gray clay-rich lithostratigraphic unit that encircles the southern part of Lake Michigan and occurs beneath the southern third of the lake basin (fig. 8).

Description

The Wadsworth Formation consists of calcareous, gray, fine textured diamicton (fig. 28) that contains lenses of sorted and stratified sediment, which is predominantly clay, silt, and fine sand. Wadsworth diamicton, generally pebbly, silty clay, contains less than 10% to 15% sand. Most diamicton beds appear relatively homogeneous and massive; some contain silt laminae and sand lenses. Dominant clast lithologies are Silurian dolomite and Devonian shale

Boundaries

Lower boundary: the contact with the undivided Lemont Formation (fig. 18), the Haeger or Yorkville Members (Lemont Formation), tongues of the Henry and Equality Formations, older units, or bedrock. Upper boundary: the contact with the Shorewood or Ozaukee Members of the Kewaunee Formation, upper tongues of the Peoria Silt and the Equality and Henry Formations, or postglacial units.

Differentiation from other units

Wadsworth diamicton is generally readily distinguished from Haeger diamicton or the undivided Lemont Formation by its finer grain size (fig. 18) and conspicuous Devonian shale clasts. Conversely, it is quite similar lithologically to Yorkville diamicton of the Lemont Formation; a vertical boundary at the West Chicago-Wilton Center moraine front is used to separate these diamictons for mapping purposes (fig. 13). In the subsurface, the Yorkville Member is not differentiated from the Wadsworth Formation unless stratigraphic control is present (e. g., the Haeger Member, undivided Lemont Formation, or tongues of the Henry and Equality Formations). Diamicton of the overlying Kewaunee Formation is distinctly redder and generally lacks the shale clasts characteristic of the Wadsworth Formation. Diamicton of the Wadsworth Formation is more illitic than diamicton of the Kewaunee Formation and the Haeger Member of the Lemont Formation, although some Wadsworth diamicton is similar to or less illitic than some Yorkville diamicton (Hansel 1983, Glass and Killey 1987).

Regional extent and thickness
The Wadsworth Formation is at the surface in the Joliet Sublobe area (fig. 13). It is generally beneath the thin Equality Formation under southern Lake Michigan south of Milwaukee, Wisconsin, and Muskegan, Michigan (fig. 8). Regionally, it forms a crescent-shaped wedge that overlaps the Lemont Formation and equivalent units in Wisconsin, Indiana, and Michigan; it pinches out beneath the Kewaunee Formation in Lake Michigan and Wisconsin. The Wadsworth Formation is thickest in the end moraine ridges that encircle the southern margin of the Lake Michigan basin, where thicknesses of up to 50 meters (164 ft) are known.

Origin
The Wadsworth Formation is interpreted to represent predominantly till and sediment that underwent redeposition in an ice-marginal and/or subaqueous environment. Hummocky topography in the area of the Valparaiso Moraine suggests that resedimentation must have been important in the deposition of part of the Wadsworth Formation. Although few exposures are available in that area for sedimentological study, water-well and core samples indicate abundant lenses of fine grained sorted sediment within the unit. The topography of the Tinley and Lake Border Moraines is less hummocky and more ridgelike than that of the Valparaiso Moraine. Ice-marginal lakes were present during the formation of these moraines, and proglacial lacustrine and mass wasting processes are recorded in the glacigenic sediment sequences (Jung and Powell 1985, Clark and Rudloff 1990, Ronnert 1992).

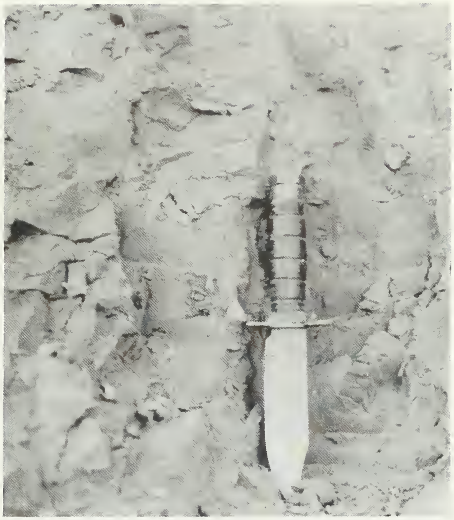


Figure 28 Silty clay diamicton of the Wadsworth Formation exposed in the Lake Michigan bluffs in Illinois.

Age and correlation
The Wadsworth Formation was deposited during the Crown Point Phase of the Michigan Subepisode when the Lake Michigan Lobe advanced out of the lake basin at its southern margin for the final time between about 15,500 and 13,800 radiocarbon years ago (Hansel and Johnson 1992; fig. 10). It correlates with the Oak Creek Formation of Wisconsin, the Wadsworth Till of Indiana, and the Saugatuck and Filer tills of Michigan (fig. 11).

Kewaunee Formation

Status
Redescribed unit. Extended to include red diamicton units beneath Lake Michigan (Shorewood, Manitowoc, and Two Rivers Members). These units originally classified as the Shorewood and Manitowoc Till Members of the Wedron Formation and the Two Rivers Till Member of an unnamed formation (Lineback et al. 1974). Defined in Wisconsin (Mickelson et al. 1984).

Source of name Kewaunee County, Wisconsin.

Original name Kewaunee Formation (Mickelson et al. 1984).

Type section Kewaunee Section, located in the lake bluff at south edge of the town of Kewaunee in Wisconsin; good for lithology of the Ozaukee, Haven, and Two Rivers Members of the Kewaunee Formation in Wisconsin and the correlative units in Lake Michigan (Shorewood, Manitowoc, and Two Rivers Members).

Principal reference section
Cedarburg Lake Bluff Section; good for lower boundary and lithology of the Shorewood-equivalent Ozaukee Member of the Kewaunee Formation.

Definition
The Kewaunee Formation is the uppermost succession of red diamicton units of the Wedron Group. Three members were differentiated in the Lake Michigan basin: a basal, red gray to pink gray, silty clay diamicton (Shorewood Member), a middle, brown to red brown, silty clay diamicton (Manitowoc Member), and an upper, red brown, silty clay diamicton (Two Rivers Member).

Background
Frye et al. (1968) defined the Wedron Formation to include the glacial tills and intercalated deposits between the Morton Loess and the top of the till below the Two Creeks forest

deposit at Two Creeks, Wisconsin. At that time, the red till above the Two Creeks forest deposit was believed to correlate with the red Valders till of eastern Wisconsin. The Valders till was inferred to extend as far south as Milwaukee (Thwaites 1946, Thwaites and Bertrand 1957). Accordingly, Frye et al. (1968) applied the name Valderan to the deposits above the Two Creeks forest deposit, and thereby introduced a threefold Woodfordian-Twocreekan-Valderan Substage division of the upper part of the Wisconsinan Stage (fig. 1).

Later, Willman and Frye (1970) defined several members of the Wedron Formation in Illinois, the youngest of which was the Wadsworth Till Member (fig. 7). Subsequent work by Lineback et al. (1974) indicated that four lithologically distinct till units (one gray and three red) occur beneath Lake Michigan. The gray till unit occurs in the southern portion of the lake basin, and Lineback et al. (1974) correlated it with the Wadsworth Till Member. On the basis of changes in color and clay-mineral and carbonate compositions, they also defined and mapped the distribution of three younger, red till members under the lake from oldest to youngest: the Shorewood, Manitowoc, and Two Rivers Till Members. Although they noted in seismic profiles a moraine on the lake floor and pinch-outs of some till units beneath younger ones, they mapped the distribution of till units predominantly on the basis of the lithology of samples from cores. Lineback et al. (1974) interpreted the Shorewood and Manitowoc Till Members to be older than the Two Creeks forest deposit; thus, they classified those till members as part of the Wedron Formation. They correlated the Two Rivers Till Member (named Two Rivers by Evenson 1973a) with the red till above the Two Creeks forest deposit at Two Creeks, Wisconsin, and assigned it to an unnamed formation of the Valderan Substage.

At about the same time, Evenson (1973a), Evenson and Mickelson (1974), and Mickelson and Evenson (1975), on the basis of work in eastern Wisconsin, suggested the type-Valders till was older than the Two Creeks forest deposit, which led Evenson et al. (1976) to conclude that the name Valderan Substage was misleading as a time-stratigraphic term for the red till overlying the Two Creeks forest deposit in Wisconsin. Evenson et al. (1976) proposed the term Greatlakean as a replacement name for Valderan. Further, they presented stratigraphic and geomorphic evidence that deemphasized the significance and extent of ice-margin fluctuations associated with the Two Creeks' and Valders' events. Recognition of pre-Twocreekan red tills obviated the necessity for a post-Two Creeks ice-margin advance as far south as Milwaukee. Instead, they argued, on the basis of the Cheboygan bryophyte site near the Straits of Mackinac (see Farrand et al. 1969, Farrand and Eschman 1974), that a major fluctuation of the ice margin occurred between the events represented by the formation of the Lake Border and Port Huron moraines (a fluctuation that coincided with a change from gray to red till).

Evenson et al. (1974) were uncertain as to how the type-Valders till correlated with other pre-Twocreekan red tills in eastern Wisconsin and Lake Michigan. Subsequent work on stratigraphic relationships of the red till units in eastern Wisconsin (Acomb 1978, McCartney 1979, Dagle et al. 1980, Acomb et al. 1982, McCartney and Mickelson 1982) culminated in the definition and description of the Kewaunee Formation (Mickelson et al. 1984), which contains all the red brown tills and associated deposits of the Lake Michigan and Green Bay Lobes that overlie the Holy Hill and Oak Creek Formations in Wisconsin (fig. 11). Diamicton of the Kewaunee Formation is typically redder than the underlying formations, and although diamicton units of the Kewaunee Formation vary in grain size, they generally contain more silt and clay than those of the Holy Hill Formation (Mickelson and Syverson, in press). Mickelson et al. (1984) differentiated ten members in the Kewaunee Formation, four in the Lake Michigan Lobe area and six in the Green Bay Lobe area. The latter are not discussed in this report.

More recently, Foster and Colman (1991) used high-resolution seismic-reflection profiles collected in the southern two-thirds of Lake Michigan to study the late Quaternary glacial and postglacial stratigraphy and map the distribution of seismic sequences and facies under the lake. Their seismic profiles and cores confirmed the presence of the four till members recognized by Lineback et al. (1974); however, unlike Lineback et al., they mapped the till members on the basis of the distribution of the seismic units. As a result, some of their unit boundaries are different from those of Lineback et al. In figure 8, we follow Foster and Colman (1991) for lithostratigraphic unit boundaries in Lake Michigan.

Description

The Kewaunee Formation consists of calcareous, red gray, pink gray, red brown, or brown, fine to medium textured diamicton units that contain lenses of sand, gravel, silt, and clay. The matrix grain size is predominantly silty clay in the lake basin, but equivalent members on land (e. g., the Valders and Two Rivers Members) contain more sand (Mickelson et al. 1984). Typically, diamicton of the Kewaunee Formation oxidizes to red brown, yellow brown, or brown.

Boundaries

Lower boundary: the contact with tongues of the Equality and Henry Formations, the Wadsworth or Holy Hill Formations, or older units. Upper boundary: the contact with upper tongues of the Equality and Henry Formations, or postglacial units.

Differentiation from other units

Diamicton of the Kewaunee Formation is redder and less illitic than that of the underlying Wadsworth Formation in the lake basin or the Wadsworth-equivalent Oak Creek Formation in Wisconsin. Beneath Lake Michigan, it is readily distinguished from the overlying bedded sediment of the Equality Formation.

Regional extent and thickness

The Kewaunee Formation (and equivalent units in Michigan) is beneath about the northern three-quarters of Lake Michigan and is the surface drift in moraines along the lake basin that extend as far south as Milwaukee, Wisconsin, and Muskegan, Michigan (fig. 8). It also extends into the northern part of the Green Bay Lobe area in Wisconsin. Thicknesses greater than 19 meters (62 ft) were reported in some exposures along the lake bluffs in Wisconsin (Mickelson et al. 1984) and thicknesses up to 49 meters (161 ft) were reported beneath Lake Michigan (Lineback et al. 1974).

Origin

The Kewaunee Formation is interpreted as the subglacial and ice-marginal facies of multiple glacigenic sequences deposited during the late phases of the Michigan Subepisode. The formation consists predominantly of till and debris-flow sediment, some of which was redeposited in a subaqueous environment. In this classification system, interfingering sorted sediments, including the interstadial organic debris (Two Creeks forest deposit) that accumulated as forest litter and was redeposited by water in some cases, are treated as tongues of the Equality and/or Henry Formation(s) of the Mason Group rather than as part of the Kewaunee Formation, as it is in the Wisconsin classification of Mickelson et al. (1984). In its type area along the lake bluffs in eastern Wisconsin, the Two Creeks forest deposit represents the OA horizon of an incipient soil and reflects a short interval of subaerial weathering under cool climate conditions. Radiocarbon ages for the Two Creeks forest deposit in eastern Wisconsin indicate that conditions conducive to the development of a weak soil prevailed in parts of the area between about 12,200 and 11,500 radiocarbon years ago.

Age and correlation
The Kewaunee Formation was deposited during the later part of the Michigan Subepisode after about 13,500 radiocarbon years ago, when the Lake Michigan Lobe ice margin first melted back far enough north to open a lower outlet for ancestral Lake Michigan at or near the north end of the basin. Readvances of 300 km (186 mi) to the outer Port Huron moraine and 200 km (124 mi) to the Two Rivers moraine occurred at about 13,000 and 11,800 radiocarbon years ago (Port Huron and Two Rivers Phases; figs. 8, 10). The Kewaunee Formation of Wisconsin and Lake Michigan correlates with drift (Monague, Riverton, and Orchard Beach tills) of the Port Huron and Manistee moraines in Michigan (fig. 11).

Shorewood Member

Status
Reclassified unit. Renamed the Shorewood Member and unit classified as part of the Kewaunee Formation. Formerly classified as the Shorewood Till Member of the Wedron Formation (Lineback et al. 1974).

Source of name Shorewood, a town along the Lake Michigan shoreline in Milwaukee County, Wisconsin.

Original name Shorewood Till Member (Lineback et al. 1974).

Type section Core 911, taken from a bedrock high between the southern and northern basins in Lake Michigan, in 90 meters (295 ft) of water about 48 km (29 mi) east of Shorewood.

Principal reference section
Cedarburg Lake Bluff Section, Wisconsin; good for lithology of the Shorewood-equivalent Ozaukee Member and lower contact with the Wadsworth-equivalent Oak Creek Formation.

Definition
The Shorewood Member consists of the lower red gray to pink gray, silty clay diamicton of the Kewaunee Formation beneath Lake Michigan.

Background
As a result of seismic profiling and coring of the bottom sediments in Lake Michigan by the ISGS and the University of Wisconsin in the early 1970s, several till members were differentiated south of Frankfort, Michigan, by Lineback et al. (1974) (fig. 7). The Shorewood Till Member of the Wedron Formation was described as a red gray to pink gray clayey till, distinguishable from the underlying Wadsworth Till Member and the overlying Manitowoc and Two Rivers Till Members on the basis of clay-mineral and carbonate compositions. On seismic profiles, the Shorewood Till Member was shown to form a prominent terminal moraine on the lake floor (Lineback et al. 1974), where it reaches thicknesses up to 49 meters (161 ft). The Shorewood Till Member was mapped in a belt, 90 kilometers (56 mi) wide, between Milwaukee, Wisconsin, and Muskegan, Michigan. The distribution of the Shorewood Till Member mapped by Lineback et al. (1974, fig. 5) shows a southward protrusion 50 kilometers (31 mi) long on the west side of the lake basin offshore from Waukegan, Illinois. Subsequent coring and seismic studies by the USGS (Colman and Foster 1990) confirmed the presence of the Shorewood Till Member as mapped by Lineback et al. (1974), except in the area of the southern protrusion where core 9V reached a gray, clay-rich diamicton that is clearly equivalent to Wadsworth rather than Shorewood till. The seismic-reflection data also indicated the Shorewood ice margin was north of where it was mapped by Lineback et al.

The Shorewood Till Member is herein renamed the Shorewood Member and reclassified as a member of the Kewaunee Formation.

Description
The Shorewood Member consists of calcareous, pink gray to pink brown, silty clay diamicton that contains lenses and beds of gravel, sand, silt, and clay. Shorewood diamicton contains more dolomite than calcite in the clay fraction; in composition and color it is intermediate between diamicton of the gray Wadsworth Formation and that of the red younger members of the Kewaunee Formation.

Boundaries
Lower boundary: the contact with a tongue of the Equality Formation, the Wadsworth Formation, older units, or Paleozoic bedrock. Upper boundary: the contact with the Manitowoc Member or the upper tongue of the Equality Formation.

Differentiation from other units
Unlike that of the underlying gray Wadsworth Formation, diamicton of the Shorewood Member contains some red hue (pink gray to pink brown), but it is not as brown or red as diamicton of the overlying Manitowoc or Two Rivers Members. Shorewood diamicton contains more expandable clay minerals, chlorite, and vermiculite and less illite than Wadsworth diamicton, but it is more illitic and (like Wadsworth diamicton) lower in total carbonate than diamicton of the overlying red Manitowoc and Two Rivers Members (Wickham et al. 1978).

Regional extent and thickness
The Shorewood Member forms a wedge-shaped deposit that extends in a belt 90 kilometers (56 mi) wide beneath Lake Michigan between Milwaukee, Wisconsin, and Muskegan, Michigan (Lineback et al. 1974, Foster and Colman 1991). It is thickest to the south, where up to 49 meters (161 ft) was reported in an end moraine that shows up on seismic profiles in the southern basin (Lineback et al. 1974). It thickens in bedrock lows and thins on highs, and it tends

to smooth the rugged topography of the bedrock high north of the southern basin of Lake Michigan, where it pinches out beneath the Manitowoc Member.

Origin
The Shorewood Member is interpreted to be the subglacial and ice-marginal facies of a glacigenic sequence in the Lake Michigan basin; it is predominantly till and subaqueous debris-flow sediment. The sequence was deposited as a result of a major readvance of the ice margin in the lake basin, and the end moraine on the lake floor likely correlates to the outer Port Huron moraine of Leverett and Taylor (1915).

Age and correlation
The Shorewood Member was deposited during the later part of the Michigan Subepisode (early Port Huron Phase) between about 13,000 and 12,500 radiocarbon years ago (Hansel and Johnson 1992; fig. 10). It likely correlates with the Ozaukee Member in eastern Wisconsin and drift of the outer Port Huron moraine (Montague till, Taylor 1990) in Michigan (fig. 11).

Manitowoc Member

Status
Reclassified unit. Name changed to the Manitowoc Member and unit classified as part of the Kewaunee Formation. Formerly classified as the Manitowoc Till Member of the Wedron Formation (Lineback et al. 1974).

Source of name Manitowoc County, Wisconsin.

Original name Manitowoc Till Member (Lineback et al. 1974).

Type section Core 904, taken about 45 kilometers (28 mi) southeast of Manitowoc, Wisconsin, in 95.4 meters (313 ft) of water; good for lithology.

Principal reference section
Core 15V; good for lithology. Kewaunee Section; good for lithology of Manitowoc-equivalent Haven Member and lower contact.

Definition
The Manitowoc Member consists of the middle, brown to red brown, silty clay diamicton of the Kewaunee Formation beneath laminated sediment under Lake Michigan north of the bedrock high between the southern and northern bathymetric basins.

Background
The Manitowoc Till Member was defined by Lineback et al. (1974) from seismic profiling and coring of the bottom sediments in Lake Michigan by the ISGS and University of Wisconsin in the early 1970s. The Manitowoc Till Member was recognized in cores as brown clayey diamicton that is typically beneath lake sediment of the Equality Formation and/or the former Lake Michigan Formation. Manitowoc diamicton contains more expandable clay minerals and less illite than the underlying Shorewood diamicton and is not as red as the overlying Two Rivers diamicton. On the seismic profiles, the distal end of the Manitowoc Till Member was interpreted to overlap the Shorewood Till Member to the south on the north side of the mid-lake bedrock high where it intertongues with lake sediment. The Manitowoc Till Member was also encountered beneath lake sediment in cores and seismic profiles taken in the central part of the lake basin by the USGS (Colman and Foster 1990).

The Manitowoc Till Member is herein classified as a member of the Kewaunee Formation and renamed the Manitowoc Member.

Description
The Manitowoc Member consists of calcareous, brown to red brown, silty clay diamicton that contains lenses of gravel, sand, silt, and clay. Manitowoc diamicton contains more total carbonate and considerably more dolomite than calcite in the clay fraction than other diamicton units beneath Lake Michigan.

Boundaries
Lower boundary: the contact with a tongue of the Equality Formation, the Shorewood Member, older units, or bedrock. Upper boundary: the contact with the Two Rivers Member of the Kewaunee Formation or an upper tongue of the Equality Formation.

Differentiation from other units
Manitowoc diamicton contains more expandable clay minerals, less illite, and more vermiculite than Shorewood diamicton. It is redder than Shorewood diamicton, but not as red as Two Rivers diamicton. Compared to the diamicton of adjacent members, diamicton of the Manitowoc Member contains more total carbonates in the clay fraction, with dolomite greatly predominating (Wickham et. al. 1978). Lineback et al. (1974) and Foster and Colman (1991) identified the Equality Formation that intertongues with the diamicton members of the Kewaunee Formation along their outermost margins. These tongues of sorted sediment help to differentiate the boundaries between members.

Regional extent and thickness
The Manitowoc Member was mapped by Lineback et al. (1974) beneath Lake Michigan over most of the area north of the mid-lake bedrock high in the Lake Michigan basin. Because of considerable relief on the bedrock, they reported a thickness range from a few centimeters to greater than 31 meters (102 ft). On seismic profiles, Foster and Colman (1991) identified three small bathymetric basins flanking the mid-lake bedrock high and a northeast-southwest trending ridge north of the basins. They found the seismic unit corresponding to the Manitowoc Member only on the high areas between the small basins, whereas the younger Two Rivers Member occurs on the northern ridge and extends into the northernmost two of the three small basins. Thus, their map shows a much smaller distribution of the Manitowoc Member than the map of Lineback et al. (1974).

Origin
The Manitowoc Member is interpreted as the subglacial and ice-marginal facies of a glacigenic sequence in the Lake Michigan basin; it is predominantly till and subaqueous debris-flow deposits. The glacigenic sequence records a readvance of the ice margin in the lake basin that probably correlates to the readvance to the Inner Port Huron moraine of Leverett and Taylor (1915) in Michigan.

Age and correlation
The Manitowoc Member was deposited during the later part of the Michigan Subepisode (late Port Huron Phase) between about 12,500 and 12,000 radiocarbon years ago (Hansel and Johnson 1992; fig. 10). It likely correlates with the Haven Member in eastern Wisconsin and drift of the inner Port Huron moraine (Riverton till, Taylor 1990) in Michigan (fig. 11).

Two Rivers Member

Status
Reclassified unit. Name changed to the Two Rivers Member, and the unit classified as part of the Kewaunee Formation. Formerly classified as the Two Rivers Till Member of an unnamed formation (Lineback et al. 1974).

Source of name	Two Rivers, a town along the Lake Michigan shoreline in Manitowoc County, Wisconsin.
Original name	Two Rivers till (Evenson 1973a).
Type section	Car Dealer Section, Two Rivers, Wisconsin; good for lithology.

Principal reference section
Two Creeks and Kewaunee Sections, Wisconsin; both good for lithology and lower boundary. Core 17V, Lake Michigan; good for lithology and upper boundary.

Definition
The Two Rivers Member consists of the upper, red brown, loam diamicton of the Kewaunee Formation beneath Lake Michigan and in the Two Rivers moraine in Wisconsin.

Background
On the basis of geomorphic and stratigraphic relationships, Evenson (1973a) concluded the upper red till that overlies the Two Creeks forest bed in the Two Rivers area was not correlative with the red till at Valders in eastern Wisconsin and, therefore, the upper red till should be treated as a separate lithostratigraphic unit. Because the term Valders till took precedent, Evenson suggested it be retained for the red till in Valders Quarry and a new name be proposed for the upper red till in the Two Rivers area. He suggested the name Two Rivers till for the new unit, which was exposed in a gravel pit in the north part of the town of Two Rivers, and he designated that area as the type locality. The Two Rivers gravel pit (later referred to as Car Dealer Section in Mickelson et al. 1984) was described as the type section of this new unit in Evenson et al. (1973).

On the basis of their coring and seismic profiles in the lake basin, Lineback et al. (1974) recognized a red till beneath Lake Michigan south of Frankfort, Michigan, that was younger than the Manitowoc Till Member. They correlated this till with the Two Rivers till of Evenson (1973a) and designated it as the Two Rivers Till Member of an unnamed formation.

Mickelson et al. (1984) classified the Two Rivers till of Evenson (1973b) as the Two Rivers Member of the Kewaunee Formation. The Two Rivers Till Member recognized by Lineback et al. (1974) beneath Lake Michigan is herein renamed the Two Rivers Member, and classified as part of the Kewaunee Formation (fig. 7).

Description
The Two Rivers Member consists of calcareous, light to medium red brown, clay to clay loam diamicton that contains lenses of gravel, sand, silt, and clay. In places on land, its matrix contains more sand. It sometimes contains organic debris from the underlying Two Creeks forest deposit. Typically, it appears redder and browner than the other red tills of the Kewaunee Formation, and it oxidizes to orange.

Boundaries
Lower boundary: the contact with tongues of the Equality and Henry Formations (including the Two Creeks forest deposit), the Manitowoc, Valders, Haven, Ozaukee, or Shorewood Members of the Kewaunee Formation, older units, or bedrock. Upper boundary: the contact with upper tongues of the Equality and Henry Formations, or other surficial units.

Differentiation from other units
Diamicton of the Two Rivers Member is redder than that of the underlying Manitowoc Member in the lake basin and it typically contains more calcite than dolomite in the clay fraction (Wickham et al. 1978). On land, Two Rivers diamicton is generally coarser grained and redder than the underlying diamicton units of the Kewaunee Formation; it contains relatively more expandable clay minerals and more calcite relative to dolomite in the clay fraction than diamicton of the Haven and Ozaukee Members (Mickelson et al. 1984). Where present, the organic-rich Two Creeks deposit provides an important marker unit below the base of the Two Rivers Member.

Regional extent and thickness
Lineback et al. (1974) reported thin patches (0–9 m; 0–30 ft) of the Two Rivers Member on the lake floor (or beneath the Lake Michigan Formation) between Manitowoc, Wisconsin, and Ludington, Michigan. Foster and Colman (1991) also identified the Two Rivers Member and ice-margin position on their seismic profiles. On land, the Two Rivers Member is the surface unit in the north-south trending Two Rivers moraine that extends from Two Rivers, Wisconsin, northward as far as Algoma. Mickelson et al. (1984) report an onshore width of about 10 kilometers (6 mi) and an average thickness of about 2.4 meters (8 ft).

Origin
The Two Rivers Member is made up of the subglacial and ice-marginal facies of a glacigenic sequence. The sequence was deposited during the final readvance (Two Rivers Phase) in the lake basin area and followed a retreat of the ice margin that extended north far enough for the Straits of Mackinac in Michigan to become ice-free (Larson et al. 1994). This retreat caused a lowering of lake level in the basin to an elevation near or below the present level of Lake Michigan. Deformed lake sediments beneath and within Two Rivers diamicton at the type section document subglacial deformation at that site during the Two Rivers advance.

Age and Correlation
The Two Rivers Member was deposited during the Two Rivers Phase of the Michigan Subepisode in the Lake

Michigan basin between about 11,800 to 11,000 radiocarbon years ago (Hansel and Johnson 1992; fig. 10). It likely correlates with drift of the Manistee moraine (Orchard Beach till, Taylor 1990) in Michigan (fig. 11).

MASON GROUP

Status
New unit. Includes the Roxana Silt, Peoria Silt, Henry Formation, and Equality Formation, all of which are revised from Willman and Frye (1970).

Source of name Mason County, central Illinois.

Original name This report.

Type section None designated. Mason County is used as the type locality; good for the relationships among several formations (Roxana Silt, Peoria Silt, and Henry Formation) of the group.

Principal reference sections
Wedron Section; good for the intertonguing relationships of the Peoria Silt and the Equality and Henry Formations of the Mason Group with the diamicton units of the Tiskilwa and Lemont Formations of the Wedron Group. Farm Creek Section; good for the Roxana Silt and the intertonguing relationships of the Peoria Silt and the Henry Formation of the Mason Group with the Tiskilwa Formation of the Wedron Group. Charleston Section; good for the intertonguing relationships of the Henry and Equality Formations of the Mason Group with the Tiskilwa Formation of the Wedron Group.

Definition
The Mason Group comprises four sorted-sediment formations that represent distinct lithofacies differentiated on the basis of grain size and bedding characteristics. Only the basal formation, the Roxana Silt, does not interfinger with the diamicton formations of the Wedron Group; locally, it interfingers with the Henry and Equality Formations, however.

Background
The Mason Group is established to classify four formations that contain fine to coarse grained, sorted sediment, occur in association with each other, and occur beneath, interfingered with, or above the diamicton formations of the Wedron Group (fig. 2). Because they primarily represent proglacial sedimentary environments that migrated with fluctuations of the ice margin during the Wisconsin Episode, these formations are in facies relationship with each other and the diamicton units of the Wedron Group.

With the exception of the Roxana Silt and the former Morton Loess, these sorted-sediment formations were formally recognized as lithostratigraphic units in the Willman and Frye (1970) classification only where they occur at or near the surface beyond the boundary of, or above units of the Wedron Group. Willman and Frye chose to classify tongues of sorted-sediment units that interfinger with diamicton units of the Wedron Group as facies of the diamicton units. They used arbitrary vertical boundaries to prevent the repetition of a unit in the same sequence (fig. 3). Although such classification of lithic facies results in a unique stratigraphic position for each unit, it tends to deemphasize the importance of buried sorted-sediment facies. Because recognition of lithic changes and correlation of sorted-sediment facies is critical in trying to understand relationships among glacial sedimentary lithofacies and in trying to predict their distribution, we established a classification framework that more clearly depicts relationships among lithic units even though it results in intertonguing of formal lithostratigraphic units.

Description
The Mason Group consists of sorted-sediment units that occur above the Sangamon Geosol and are differentiated predominantly on the basis of grain size and bedding characteristics. Four units of formation rank are recognized: (1) a basal unit, the Roxana Silt, generally lacks bedding structures, has a red brown cast, and appears massive in exposures (fig. 29); (2) the Peoria Silt, a yellow brown to gray silt that generally lacks bedding structures and appears massive in exposures (fig. 29); (3) the Henry Formation, predominantly bedded sand and gravel (fig. 30); and (4) the Equality Formation, predominantly silt and clay that generally shows some evidence of bedding (fig. 31). Some of these units, most commonly the Henry and Equality Formations and the Peoria Silt, intertongue with the diamicton formations of the Wedron Group.

Boundaries
Lower boundary: the contact with diamicton tongues of the Wedron Group, or with the Sangamon Geosol, the Loveland Silt, the Glasford, Winnebago or Pearl Formations, or older units. Upper boundary: the contact with diamicton tongues of the Wedron Group or postglacial units.

Differentiation from other units
Generally, the Mason Group is readily distinguishable from the diamicton units of the Wedron Group. Tongues and lenses of the Mason Group can be differentiated from lenses of sorted sediment within the Wedron Group because the Mason Group tongues and lenses are more laterally continuous and occur at specific stratigraphic positions. Where the Mason Group overlies other sorted-sediment formations or sorted sediment within the Glasford or Winnebago Formations or older units, its relationships to key pedostratigraphic units (e. g., the Sangamon Geosol) or changes in lithology are helpful in differentiating it from other units.

Regional extent and thickness
The Mason Group is an extensive unit that blankets most of Illinois, and it ranges in thickness from less than 1 meter (3.3 ft) to about 30 meters (98 ft). It is present over much of the Lake Michigan Lobe area, including beneath Lake Michigan (Lineback et al. 1970). Beyond the Lake Michigan Lobe area, the Mason Group is thickest along the Illinois, Mississippi, Rock, Wabash, and Ohio River valleys (plate 1; Wanless 1957, Willman and Frye 1970, Frye et al. 1972, Willman 1973). The Mason Group formations are not known to occur in any one succession, but the occurrence of two or three formations in sequence or in facies relationship at one site is not uncommon.

Origin
The Mason Group is interpreted to be predominantly proglacial sediment of the Wisconsin Episode, although some

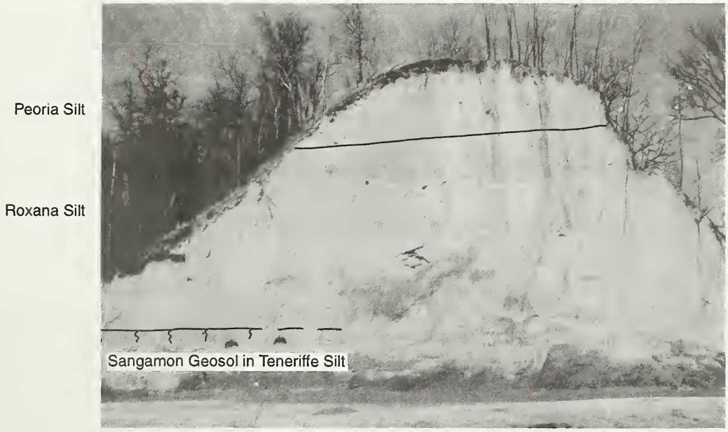


Figure 29 Loess of the Peoria and Roxana Silts above the Sangamon Geosol developed in the Teneriffe Silt (Illinois Episode) at the Pleasant Grove School Section. The modern soil is developed in the upper part of the Peoria Silt.

Figure 30 Stratified and crossbedded proglacial sand and gravel of the Henry Formation.

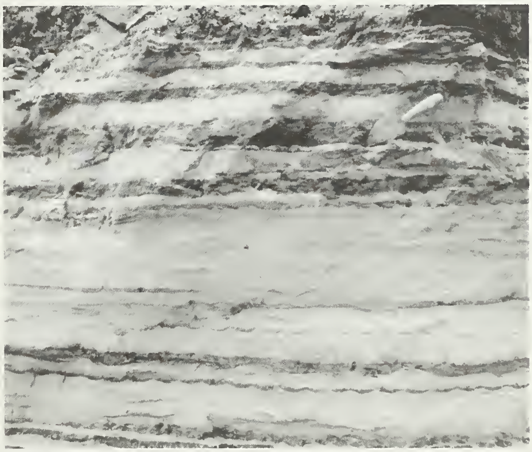


Figure 31 Ripple and planar bedded silt, clay, and fine sand of the Equality Formation.

postglacial sediment of the Hudson Episode is included. It consists of loess, eolian sand, outwash, and lacustrine sediment. This sediment, together with the intertonguing diamicton units of the Wedron Group, represents multiple glacigenic sequences that record the events of the last glaciation.

Age and correlation

The bulk of the Mason Group was deposited during the Wisconsin Episode between about 70,000 and 11,000 radiocarbon years ago, but parts of it (e. g., Lake Michigan Member, Equality Formation) were deposited during the postglacial Hudson Episode (appendix B). The Mason Group correlates in part with the Martinsville and Atherton Formations of Indiana (Wayne 1963) and unnamed units in Wisconsin, Iowa, Missouri, and Michigan.

Roxana Silt

Status

Revised unit. Upper boundary locally extended to include materials formerly included in the Robein Silt, which is reclassified as the Robein Member of the Roxana Silt.

Source of name Roxana, a village in Madison County, southwestern Illinois.

Original name Roxana silt (Frye and Willman 1960).

Type section Pleasant Grove School Section (fig. 29), located in the bluff of the Mississippi Valley 4 miles (6.4 km) southeast of Roxana; good for lithology and lower contact. No longer available, has been mined out for fill.

Principal reference sections

Arenzville, Athens North Quarry, Bellefontaine Quarry, Cottonwood School, Farm Creek, and Glendale School Sections; all good for lithology and contacts.

Definition

The Roxana Silt is a unit dominated by silt, which occurs above the Sangamon Geosol and below the Peoria Silt (fig. 29), the Henry and Equality Formations, or the Wedron Group. The Farmdale Geosol commonly occurs in the top of the Roxana Silt.

Background

Frye and Willman (1960) named the Roxana Silt for a succession of distinctive silt units that occur above a well-developed buried soil, the Sangamon Geosol, and below the Peoria Silt. The Roxana Silt was previously called the Farmdale loess (Leighton and Willman 1950) or late Sangamon loess (Leighton 1931, 1933, Smith 1942, Wascher et al. 1948). The unit was formalized as a formation in 1970 (Willman and Frye), and three members were defined within it: the Markham Silt, a sandy and commonly weathered unit at the base; the McDonough Loess, a gray to tan unit; and the Meadow Loess, a thick upper unit that locally contains three color zones: pink tan at the base, gray tan in the middle, and pink tan at the top. Although no changes in these members are made in this report (except removal of genetic terms from their names), the stratigraphic significance of the Markham and McDonough Members was questioned by McKay (1979b), who was not able to identify them on stable upland landscape positions. The Markham Member was recognized on more sloping landscape positions (Frye et al. 1974), and Curry and Follmer (1992) recognized the Markham and Meadow Members, but not the McDonough Member, as being valid. Where the Roxana Silt is thin (less than 1 m [3.3 ft] thick), appreciable sand commonly occurs throughout, and it has been referred to as the sandy silt facies (Johnson et al. 1972). In this revision, the Roxana Silt is retained as a formation, and the former Robein Silt, which is lithologically related to the Roxana Silt, is classified as the uppermost unit, the Robein Member, within the formation (fig. 9a).

Description

The Roxana Silt is dominated by silt and is commonly brownish red in oxidized occurrences and gray where it is water saturated. The basal portion and, if thin, the entire unit contains appreciable sand (15%–30%) and clay (15%–20%) where it overlies weathered sandy materials. In many exposures it appears massive with abundant biopores and root traces. The Roxana Silt is usually leached of carbonates, except where the unit is thick and its central portion is dolomitic; color strata and pulmonate gastropods are common in thick occurrences. The upper part, usually weathered and noncalcareous, represents the Farmdale Geosol.

Boundaries

Lower boundary: the contact with the Glasford or Winnebago Formations, Loveland Silt, Pearl Formation, or older units. Upper boundary: the contact with the Peoria Silt, the Henry, or Equality Formations, or the Wedron Group. Both upper and lower boundaries are usually gradational rather than distinct.

Differentiation from other units

Although the Roxana Silt is lithologically distinct from diamicton of the Glasford Formation, its lower contact with the Glasford Formation is commonly gradational with the Sangamon Geosol as a result of pedogenic processes during its deposition. In well and poorly drained situations, this contact usually occurs in the upper soil horizon(s) of the Sangamon Geosol. The contact is drawn where (1) silt dominates the texture, (2) pedogenic characteristics are less evident and less developed, and (3) relatively unweathered minerals occur in the sediment. The same criteria for determining the contact are used where the Roxana Silt overlies silt formations (Loveland Silt, Teneriffe Silt) of the Illinois Episode, except in such cases texture is less useful. Although the contact between the Roxana and Peoria Silts is generally gradational, the Roxana Silt can usually be distinguished from the Peoria Silt by color. The Roxana Silt is more red brown, whereas the Peoria Silt is more yellow brown. Also, the upper portion of the Roxana Silt is commonly weathered and contains pedogenic character related to the Farmdale Geosol. The Roxana Silt can be readily distinguished from the diamicton formations of the Wedron Group.

Regional extent and thickness

The distribution of the Roxana Silt is widespread in the midcontinent region; it occurs from Minnesota and Wisconsin south to Mississippi and Louisiana, and its distribution is clearly related to major river valleys. It is thick (5–15 m; 16–49 ft) only along the middle and southern portions of the Illinois Valley (ancient Mississippi Valley Fehrenbacher et. al 1986), and south along the Mississippi Valley. It is thin along other valleys. Variation in thickness of the Roxana Silt along the ancient Mississippi Valley can be explained by variations in valley relief, width, and orientation and distance from source valley (Johnson and Follmer 1989, Leigh 1991).

Origin
The Roxana Silt is interpreted to be predominantly loess (Smith 1942, Wascher et al. 1948, Frye and Willman 1960, McKay 1979b). Locally, portions of it are colluvial (Frye et al. 1974); much of it has been pedogenically modified. The loess was derived primarily from the floodplain of the ancient Mississippi River, and most geologists suggested that it is related to glacially derived valley train sediment (Wascher et al. 1948, Willman and Frye 1970, McKay 1979b, Johnson and Follmer 1989, Leigh 1991, 1994). Other origins were suggested by Ruhe and Olson (1978), Winters et al. (1988), and Norton et al. (1988).

Age and correlation
The Roxana Silt was deposited during the Alton Phase of the Athens Subepisode of the Wisconsin Episode (fig. 10). Estimates on the age of the lower boundary have varied from about 75,000 radiocarbon years to 45,000 or 55,000 radiocarbon years (Willman and Frye 1970, McKay 1979b, Curry and Follmer 1992, Leigh and Knox 1993); the minimum age on the upper boundary is about 27,000 radiocarbon years (Leigh and Knox 1993). The Roxana Silt correlates with the Gilman Canyon Formation of Nebraska (Reed and Dreeszen 1965), the Pisgah Formation of Iowa (Bettis et al. 1990), the Roxana Formation of Wisconsin (Leigh and Knox 1994), and part of the Atherton Formation of Indiana (Wayne 1963).

Robein Member

Status
Revised unit. Reduced in rank to member of the Roxana Silt. Formerly classified as a formation.

Source of name Robein, a village in Tazewell County.

Original name Robein Silt (Willman and Frye 1970; a direct replacement name for Farmdale silt, Frye and Willman 1960).

Type section Farm Creek Section, along the south side of Farm Creek, 2 kilometers (1.3 mi) south of Sunnyland, Illinois; still exposed, but the Robein Member only locally present along the exposure.

Principal reference sections
Athens Quarry North, Danvers, and Charleston Quarry Sections; all good for lithology and contacts.

Definition
The Robein Member consists of stratified to massive silt, sandy silt, humic material, and peat. Where present, it occurs as the uppermost member of the Roxana Silt. It is overlain by the Peoria Silt, the Henry and Equality Formations, or the Wedron Group. The Farmdale Geosol is developed in it, and pedogenesis commonly obscures stratification within the unit (fig. 32).

Background
Frye and Willman (1960, p. 6) defined the Farmdale silt as "... massive silt, noncalcareous, light brown to pale purple, that commonly contains wood fragments and locally is replaced by peat." They interpreted it to be primarily silt that was derived from the Roxana Silt and reworked by sheetwash and colluvial processes. The unit was renamed Robein Silt in 1970 by Willman and Frye to avoid confusion because the name Farmdale also had been applied to other sediment (Leighton 1960). They indicated the Robein Silt accumulated primarily during the Farmdalian Subage.

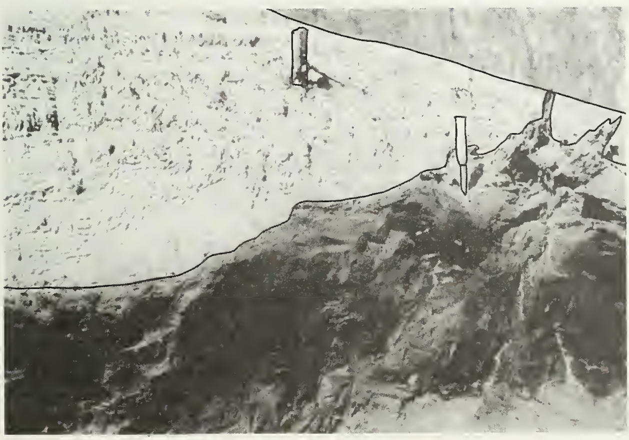


Figure 32 Lacustrine silt of the Peddicord Tongue of the Equality Formation above forest litter (including spruce stumps) of the Farmdale Geosol developed in the Robein Member of the Roxana Silt at Charleston Quarry.

Because the Robein Silt is leached and commonly contains organic remains, it is a distinctive stratigraphic marker unit (Horberg 1953, Kempton et al. 1991) and the most widely radiocarbon-dated unit in Illinois (Willman and Frye 1970).

Although distinct and traceable in the subsurface, the Robein Silt is thin (usually less than 2 m [6.6 ft] thick). In this report, we have lowered it in rank to a member and included it in the Roxana Silt (fig. 9a), to which it is lithologically related.

Description

The Robein Member consists of light to dark brown to black, noncalcareous, stratified to massive silt loam that often contains organic debris. Locally, the uppermost layer of the unit is peat or muck (O horizon of the Farmdale Geosol).

Boundaries

Lower boundary: the contact with the undivided Roxana Silt or other formal members of Roxana Silt, the Glasford Formation, or other Illinoian or older units. Upper boundary: the contact with the Peoria Silt, the Henry and Equality Formations (fig. 32), or the Wedron Group. Contacts with the Roxana and Peoria Silts are usually gradational, whereas the contacts with the diamicton formations are abrupt.

Differentiation from other units

The Robein Member of the Roxana Silt is differentiated within the formation by a combination of properties, mainly the presence of stratification or brown to black color and organic debris, as well as by its stratigraphic position at the top of the formation. It is distinct from organic silt that may occur in the overlying Peoria Silt in that it is leached of carbonate minerals and has pedogenic features; the undivided Peoria Silt and the Morton Member generally are dolomitic.

Regional extent and thickness

The Robein Member is discontinuous in the subsurface over an extensive area of Illinois. In northeastern Illinois, it occurs beneath the Tiskilwa Formation or tongues of the Peoria Silt and Henry and Equality Formations, whereas in central, western, and southern Illinois, it occurs beneath the Peoria Silt (Horberg 1953, Kempton et al. 1991). It commonly is less than 2 meters (6.6 ft) thick, but locally may be greater than 4 meters (13 ft) thick.

Origin

The Robein Member is interpreted to represent silt and organic debris that accumulated in poorly drained, low- or flat-lying landscape positions and depressions prior to the beginning of the Michigan Subepisode. Commonly, it is in facies relationship with and was derived from Roxana loess, and it generally contains all or the upper part of the Farmdale Geosol in poorly drained situations.

Age and correlation

The Robein Member was deposited during the Athens Subepisode (fig. 10) from before 50,000 to about 20,000 radiocarbon years ago (appendix B2). Although originally thought to have accumulated mainly in the Farmdale Phase (Farmdalian Subage of Willman and Frye 1970), subsequent work has shown that locally it began to accumulate during the early part of the Alton Phase (fig. 10; Curry and Kempton 1985, Curry and Follmer 1992). The Robein Member correlates with similar unnamed silt units at this stratigraphic position in Wisconsin, Indiana, and Michigan.

Peoria Silt

Status

Revised Unit. Formation extended to include the former Morton and Richland Loesses; silt used in name to replace lithogenetic term loess.

Source of name Peoria, a city along the Illinois Valley in Peoria County.

Original name Peorian soil and weathering interval (Leverett 1899).

Type section Tindall School Section in the west bluff of the Illinois Valley south of Peoria; good for lithology and lower boundary.

Principal reference sections

Athens North Quarry, Bellefontaine Quarry, and Cottonwood School Sections; all good for lithology and lower boundary. Danvers, Gardena, and Farm Creek Sections; all good for lithology, lower boundary, and intertonguing relationship with the Tiskilwa Formation of the Wedron Group.

Definition

The Peoria Silt consists of a silt unit that overlies the Roxana Silt (fig. 29) or other units and interfingers with diamicton units of the Wedron Group and sorted sediment units of the Henry and Equality Formations of the Mason Group, of which it is a part. Where it is at the surface, the modern soil has developed in its upper part (fig. 29). The lower tongue of the Peoria Silt that extends below the Delavan Member or undivided Tiskilwa Formation of the Wedron Group is recognized herein as the Morton Tongue of the Peoria Silt.

Background

The term Peorian was introduced by Leverett (1899) for a soil that he inferred to have formed during an interglacial interval. Later, Alden and Leighton (1917) applied the term to loess deposits previously called Iowan. Kay and Leighton (1933) restricted usage of the term Peorian to loess beyond the limit of the Shelbyville till (the Wedron Group of this report). The name was modified to Peoria loess by Frye and Leonard (1951) for use as a lithostratigraphic unit in Kansas, and that usage was introduced in Illinois by Frye and Willman in 1960. In 1970, Willman and Frye designated separate formations for the unit below, beyond, and above the diamicton deposits of the last glacial episode. They are the Morton, Peoria, and Richland Loesses, respectively. At the glacial limit, the Morton and Richland Loesses were separated from laterally equivalent silt of the Peoria Loess by arbitrary vertical boundaries (fig. 3).

We have retained the Peoria Silt as a lithostratigraphic unit at formation rank. The former Morton and Richland Loesses are not retained at formation rank; instead, they are treated as tongues of the Peoria Silt that underlie and overlie the Wedron Group, respectively (fig. 9a). The Morton Tongue is a thin (generally less than 2 m [6.6 ft] thick) subsurface unit that is present only within a zone about 50 kilometers (31 mi) wide in the up-ice direction from the western and southern margins of the Wedron Group (Kempton and Gross 1971). It is recognized in this report as a formal tongue of the Peoria Silt. By contrast, the Richland tongue is not recognized as a formal tongue of the Peoria Silt; instead, the name Peoria Silt is applied to the unit both beyond and above the Wedron Group. This practice is consistent with how the uppermost tongues of the Equality and Henry Formations are treated, and it has been the practice of some other scientists in Illinois (e. g., Fehrenbacher et al. 1986).

Locally, the Peoria Silt is interfingered with well-sorted (eolian) sand. Where at the surface, this sand was formerly classified as the Parkland Sand. In this report, the Parkland Sand is not retained as a formal unit, but sand intertonguing with silt of the Peoria Silt could be recognized as the Parkland facies of the Peoria Silt.

Description
The Peoria Silt generally is light yellow tan to gray silt that grades from sandy silt in the bluffs of major source valleys to clayey silt away from the bluffs, where it typically is thinner and weathered. It is dolomitic below the weathered zone and generally lacks bedding structures, although faint bedding is sometimes observable in thick bluff sections near major river valleys. Locally, it may contain beds of well-sorted sand, fossil snail shells, organic debris, wood, and rarely clay layers. At the Gardena and Danvers Sections in Tazewell and McLean Counties, respectively, the Morton Tongue of the Peoria Silt contains a thin organic layer, including an in situ moss bed in the upper few centimeters.

Boundaries
Lower boundary: the generally gradational contact with the Roxana Silt or older units. Upper boundary: the contact with upper tongues of the Henry and Equality Formations, postglacial units, or the land surface; the modern soil has developed in the upper part of the unit.

Differentiation from other units
The Peoria Silt is differentiated from the red brown Roxana Silt or older silt units by its yellow brown to gray color, lack of significant weathering and soil characteristics below the modern soil, presence of carbonates (predominantly dolomite), and stratigraphic position.

Regional extent and thickness
The Peoria Silt is an extensive unit that occurs throughout the midcontinent region. It extends north to Minnesota and Wisconsin, east to Ohio, south to Mississippi and Louisiana, and west to Kansas and Nebraska (Ruhe 1983). It is clearly valley related and thickest along the Illinois, Mississippi, Missouri, Wabash, and Ohio River valleys, where it ranges from 10 to 25 meters (33–82 ft) thick in the bluff area along the widest portions of these valleys. It thins away from the valleys, but is present in most upland areas beyond the boundary of Michigan Subepisode glaciation (Smith 1942, Leighton and Willman 1950, McKay 1979b, Fehrenbacher et al. 1986).

Origin
The Peoria Silt is interpreted to be predominantly proglacial loess derived from glacial meltwater channels. The Morton Tongue, which was derived primarily from the Illinois (ancient Mississippi) River valley, was later overridden by the advancing glacier during the Michigan Subepisode. In some areas the Peoria Silt contains small amounts of eolian sand, and locally it contains colluviated and sheetwash silt.

Age and correlation
The Peoria Silt was deposited adjacent to major meltwater channels during the Michigan Subepisode. Deposition began at different times in different valleys, depending on the time meltwater was released from the glacier to ancient drainageways (appendix B2). For example, adjacent to the lower Illinois (ancient Mississippi) Valley in central and western Illinois, deposition of the Peoria Silt began about 25,000 radiocarbon years ago or slightly earlier (McKay 1979b). Near the Mississippi (ancient Iowa) Valley in western Illinois, however, loess deposition did not begin until about 20,000 radiocarbon years ago, after the advancing Lake Michigan Lobe had diverted the ancient Mississippi River to its present course along the western boundary of Illinois (fig. 4a). Most of the Peoria Silt was deposited by about 12,500 radiocarbon years ago. The Peoria Silt correlates with the Vicksburg Loess in Mississippi (Krinitzsky and Turnbull 1967) and part of the Atherton Formation (Wayne 1963) in Indiana.

Morton Tongue

Status
Revised unit. Downgraded in rank to a tongue of the Peoria Silt and name changed to the Morton Tongue.

Source of name Morton, a village in Tazewell County, central Illinois.

Original name Morton Loess (Frye and Willman 1960).

Type section Farm Creek Railroad Cut Section, located 9.6 kilometers (6 mi) northwest of Morton. No longer exposed.

Principal reference sections
Farm Creek Section, Gardena Section (fig. 16), Glendale School Section, Danvers Section; all good for lithology and contacts.

Definition
The Morton Tongue is the Peoria Silt that extends beneath the Tiskilwa Formation of the Wedron Group.

Background
In 1960, Frye and Willman applied the term Morton to the loess that occurs stratigraphically above the "Farmdale silt," which they later (Willman and Frye 1970) named the Robein Silt, and below the "Shelbyville till" (Wedron Formation of Willman and Frye 1970). Before 1960, the Morton Tongue was called the "Iowan loess" (Leighton 1933, Leighton and Willman 1950), but Frye and Willman (1960) maintained it required a separate lithostratigraphic name because radiocarbon evidence indicated it was at least 15,000 years younger than the type "Iowan" of Iowa. In this report, the Morton Loess is classified as the Morton Tongue of the Peoria Silt (fig. 9a); it is the lower tongue of the Peoria

Silt that extends below the Tiskilwa Formation of the Wedron Group.

Description
The Morton Tongue consists of gray to yellow tan, dolomitic, fossiliferous silt that is generally unbedded but is locally organic-rich. The fossil content consists of dispersed pulmonate gastropod shells that are often crushed and fragmented. At the Gardena and Danvers Sections, it contains a thin organic layer, including an in situ moss bed in the upper few centimeters. Locally, the Morton Tongue also contains stratified layers of peat, muck, and wood, which have yielded radiocarbon ages ranging from about 26,000 to 20,000 years old (appendix B2).

Boundaries
Lower boundary: the gradational to fairly abrupt contact with the Robein Member of the Roxana Silt or the contact with older units. Upper boundary: the contact with the Ashmore Tongue (Henry Formation), the Peddicord Tongue (Equality Formation), the Delavan Member (Tiskilwa Formation), or the undivided Tiskilwa Formation.

Differentiation from other units
The underlying Robein Member of the Roxana Silt is usually leached of carbonates, stratified, and more organic-rich than the Morton Tongue. The silt of the Morton Tongue is readily distinguishable from the overlying coarse grained sediment of the Ashmore Tongue and the diamicton units of the Delavan Member and undivided Tiskilwa Formation. In contrast to the fine grained sediment of the Peddicord Tongue, silt of the Morton Tongue generally lacks bedding structures.

Regional extent and thickness
The Morton Tongue is a subsurface, wedge-shaped unit that occurs in a belt about 50 kilometers (31 mi) wide in the up-ice direction from the western and southern margin of the Wedron Group. It is generally less than 2 meters (6.6 ft) thick and pinches out beneath the Tiskilwa Formation to the north and east (Kempton and Gross 1971).

Origin
The Morton Tongue is proglacial loess that was deposited beyond and later overridden by the advancing Michigan Subepisode glacier. The loessal silt was derived primarily from the Illinois (ancient Mississippi) River valley.

Age and correlation
The Morton Tongue was deposited during the early part of the Michigan Subepisode between about 26,000 and 20,000 radiocarbon years ago. It is laterally equivalent with the lower part of the Peoria Silt in the area beyond the Wedron Group boundary and with part of the Atherton Formation (Wayne 1963) in Indiana.

Henry Formation

Status
Redescribed unit. Formation redescribed to remove lithogenetic concepts from its definition and recognized as intertonguing with diamicton units of the Wedron Group, as well as with other sorted-sediment units of the Mason Group.

Source of name Henry, a village in Marshall County, central Illinois.

Original name Henry Formation (Willman and Frye 1970).

Type section A gravel pit along Illinois Highway 29, 2 miles (3.2 km) north of Henry, Illinois; no longer exposed.

Principal reference sections
Beverly Sand and Gravel Pit (fig. 19) and Wedron and Charleston Quarry Sections; both good for intertonguing relationship with the Wedron Group (figs. 12, 15).

Definition
The Henry Formation consists of stratified sand and gravel that occurs above the Sangamon Geosol. It intertongues with other formations of the Mason Group, particularly the Equality Formation, and the diamicton formations of the Wedron Group. In major river valleys, it is commonly overlain by the Cahokia Formation. Two tongues of the Henry Formation are formally recognized, the Ashmore Tongue (figs. 12, 15), which extends beneath the Delavan Member or the undivided Tiskilwa Formation, and the Beverly Tongue (fig. 19), which extends beneath the Haeger Member of the Lemont Formation.

Background
The Henry Formation was defined by Willman and Frye (1970) as glacial outwash, predominantly sand and gravel, that occurs above the Sangamon Soil and is either at the surface or overlain by the Richland Loess or post-Wedron formations; it was classified with the Wisconsinan Stage. Willman and Frye included similar deposits that underlie or intertongue with till of the Winnebago and Wedron Formations as sand and gravel facies of those formations; they separated them from the Henry Formation by arbitrary vertical boundaries (fig. 9b). They differentiated three members in the Henry Formation, the Batavia, Mackinaw, and Wasco.

Like the formation, these members are lithogenetic units. They were defined on the basis of genesis and morphology; yet, because the three members represent different sedimentary environments, they generally have different lithologic characteristics as well. The Batavia Member, defined as an upland unit deposited mostly along the fronts of moraines (outwash plains), consists of deposits that vary more in degree of coarseness, both vertically and laterally, over shorter distances than do deposits of the Mackinaw Member, which was defined as outwash deposited in valleys (valley trains). Sand and gravel of the Mackinaw Member, generally sandy gravel or pebbly sand, is more evenly bedded and more uniform in texture than that of the Batavia Member or the Wasco Member, which consists of ice-contact sand and gravel in kames, eskers, and deltas. Deposits of the Wasco Member are the most variable of the three members in grain size, sorting, bedding, and structure. The three members tend to grade into and interfinger with each other. For example, where outwash plains converge into the valleys, the Batavia Member grades into the Mackinaw Member, whereas deposits of pitted outwash plains of the Batavia Member may grade into ice-contact deposits of the Wasco Member in the up-ice direction.

We redescribe the Henry Formation in two ways: (1) on the basis of lithostratigraphic rather than lithogenetic criteria, and (2) as a lithostratigraphic unit that intertongues with the diamicton units of the Wedron Group (i. e., lateral extensions of the unit interfingering with diamicton units of the Wedron Group are classified as tongues of the Henry Formation rather than vertical facies within diamicton units, separated from the Henry Formation by vertical boundaries; fig. 9b). As redescribed, the Henry Formation consists of fine to coarse grained, well to poorly stratified sediment of predominantly sand and gravel that overlies the Sangamon Geosol and interfingers with the Wedron Group diamicton units and other Mason Group sorted-sediment formations. In this revision, more sediment is classified as the Henry Formation than previously. Included are not only tongues of outwash sand and gravel interfingered with other units, but also sand and gravel formerly classified as the Parkland Sand, the Dolton Member of the Equality Formation, and the Ravinia Sand Member of the Lake Michigan Formation.

Two tongues are formalized in the Henry Formation. The Ashmore Tongue (fig. 12) occurs stratigraphically below diamicton of the Tiskilwa Formation and above the Peddicord Tongue of the Equality Formation, the Morton Tongue of the Peoria Silt, or the Robein Member of the Roxana Silt. The Beverly Tongue (fig. 19) occurs stratigraphically below the Haeger Member of the Lemont Formation and above other units of the Wedron or tongues of the Equality Formation. The lithogenetic-based Batavia, Mackinaw, and Wasco Members of the Henry Formation defined by Willman and Frye (1970) are not retained as formal lithostratigraphic units; instead, the names are retained for informal sedimentary facies that are helpful in understanding glacial history and predicting relationships among materials. The former Dolton Member of the Equality Formation and Ravinia Sand Member of the Lake Michigan Formation are also treated herein as an informal facies (nearshore lacustrine) of the Henry Formation. Likewise, most of the former Parkland Sand (well sorted, fine to medium grained sand that generally occurs near the surface in dunes or sheetlike deposits) is treated as an informal facies (eolian) of the Henry Formation. Other informal units will be designated as the need arises in regional and local studies (e. g., designations to separate Haeger-related Henry Formation from Tiskilwa-related Henry Formation in those places where the two occur together in the same map area). Many of these informal facies are meaningful map units.

Description

The Henry Formation consists predominantly of stratified sand and gravel (fig. 30) that is similar in lithology to the sand and gravel fractions of diamicton units of the Wedron Group. Lenses of silt, clay, organic debris, wood, and shells occur locally in the sand and gravel. The dominant pebble lithology is Paleozoic carbonate similar to that of bedrock in northeastern Illinois, southeastern Wisconsin, and the Lake Michigan basin, but Paleozoic sandstone and shale, as well as igneous and metamorphic rock, are also common. Considerable lateral and vertical variation is present in grain size, sorting, bedding, and structure of deposits within the formation.

The Ashmore Tongue of the Henry Formation is lithologically similar in pebble and carbonate compositions to diamicton of the Tiskilwa Formation, whereas the Beverly Tongue is lithologically similar to diamicton of the Haeger Member of the Lemont Formation.

Boundaries

Lower boundary: the contact with tongues of the Wedron Group, Peoria Silt, Equality Formation, and Roxana Silt, or the Loveland Silt, Pearl, Glasford, and Winnebago Formations, or older units. Upper boundary: the contact with the Wedron Group, Peoria Silt, and Equality Formation, or postglacial units, particularly the Cahokia Formation and Grayslake Peat.

Differentiation from other units

The coarse, stratified sediment of the Henry Formation is generally readily distinguishable from the diamicton units of the Wedron Group and Glasford and Winnebago Formations, but sand and gravel lenses that occur within the diamicton units could be mistaken for tongues of the Henry Formation, particularly in the subsurface. Sand and gravel lenses within the diamicton units are generally thinner and less continuous than tongues of the Henry Formation, which occupy distinct stratigraphic positions and can be traced regionally. Although some contacts are gradational and interfingered, the Henry Formation is generally distinct from other sorted-sediment formations of the Mason Group. It may be similar to sand and gravel of the Pearl Formation, but the two units can be distinguished where the Sangamon Geosol is developed in the top of the Pearl Formation. Where the Henry Formation is overlain by silt, sand, and gravel of the Cahokia Formation, the contact between the two units may be gradational; however, the Cahokia Formation is commonly finer grained, and it does not intertongue with the diamicton units of the Wedron Group as does the Henry Formation.

Regional extent and thickness

The Henry Formation or correlative sediment in adjacent states is present in nearly all the counties that were inundated by the Lake Michigan Lobe during the Michigan Subepisode, but its distribution is discontinuous and extends beyond the glacier margin (plate 1). It most commonly occurs as (1) relatively thin sheetlike deposits wedging out in the up-ice direction beneath diamicton formations and thinning in the down-ice direction away from moraine fronts, (2) ribbonlike deposits along the major drainageways leading away from the moraines and inset in older deposits of both glacial and nonglacial origins, (3) ribbonlike and fanlike deposits along the margins of former or modern lakes, and (4) moundlike and sheetlike deposits around the margin of modern and ancient lakes and on terraces and upland surfaces in and adjacent to the major valleys. The Henry Formation is less commonly found in esker and kame deposits in the Wedron Group area in Illinois. Except where later erosion removed them, the Henry Formation deposits discussed above commonly connect with each other and/or with the fine grained sediment of the Peoria Silt and Equality Formation. The Henry Formation varies considerably in thickness, ranging from more than 65 meters (213 ft) in some of the major valleys to less than 1 meter (3.3 ft) in fans and aprons along moraine fronts or in the subsurface between diamicton units; laterally equivalent units in Indiana and Michigan are even thicker. The sand and gravel resources mapped in northeastern Illinois by Masters (1978) are predominantly of the Henry Formation.

Origin

The Henry Formation is interpreted to be (1) outwash deposited adjacent to or leading away from the glacier, (2) nearshore sand and gravel deposited in beaches, spits, bars, and deltas in glacial and postglacial lakes, and (3) eolian sand derived from glaciofluvial, fluvial, and nearshore lake sediments deposited in dunes and sheets on and adjacent to those sediments.

Age and correlation

Most of the Henry Formation was deposited during the Wisconsin Episode, predominantly during the Michigan Subepisode between about 26,000 and 11,000 radiocarbon years ago (appendix B2). Some of the Dolton, Ravinia, and Parkland facies are much younger, however, and date up to modern times (Hudson Episode). The Henry Formation correlates with part of the Atherton and Martinsville Formations in Indiana (Wayne 1963) and unnamed units in Wisconsin, Iowa, Missouri, and Michigan.

Ashmore Tongue

Status

Redefined, reclassified, and redescribed unit. Name changed to Ashmore Tongue, unit reclassified as part of the Henry Formation, and description modified to include only medium to coarse grained, stratified sediment. Formerly classified as the Ashmore Member of the Wedron Formation (Ford 1973).

Source of name Ashmore, a village in Coles County, east-central Illinois.

Original name Ashmore Member, Wedron Formation (Ford 1973).

Type section Charleston Section (fig. 15), Charleston Stone Quarry pits, located on both sides of the Embarras Valley about 8 kilometers (5 mi) east-northeast of Charleston; good for boundaries and lithology.

Principal reference section

Wedron Section (fig. 12); good for boundaries and lithology.

Definition

The Ashmore Tongue is the stratified sand and gravel of the Henry Formation that extends beneath the basal red gray diamicton unit of the undivided Tiskilwa Formation or the gray diamicton unit of the Delavan Member of the Tiskilwa Formation. In places it is interfingered with other units of the Mason Group, for example, the Peddicord Tongue (Equality Formation) and the Morton Tongue (Peoria Silt).

Background

Ford proposed the Ashmore Member in 1973 for the sequence of stratified sediment (laminated silt and organic matter, and sand and gravel) at the base of Wedron Formation diamicton in the Charleston Stone Quarry pits along both sides of the Embarras Valley. He found the clay-mineral and carbonate compositions of the basal silt of the Ashmore Member to be similar to that of the overlying diamicton and the upper part of the sand and gravel to be intercalated with the diamicton in places. Wood from a log embedded in laminated silt of the Ashmore Member yielded a radiocarbon age of 19,500 years before present. Ford (1973) correlated the Ashmore Member with basal laminated silt reported by Johnson et al. (1971a) in the Wedron Formation at Shelbyville and basal laminated silt in the Wedron Formation at the Harmattan Strip Mine Section near Danville (Johnson et al. 1972). Ford (1973) reported that the sand and gravel of the Ashmore Member is widely distributed in the subsurface in Coles County, where it is up to 10 meters (33 ft) thick and commonly constitutes an important sand and gravel resource, as well as the most widespread, productive aquifer of the area. Kempton et al. (1982) later used the name "Ashmore" to refer to the aquifer at the base of the Wedron Formation.

The concept of a lithostratigraphic unit for the stratified, sorted sediment at the base of the Wedron sequence was also used at the Wedron Formation type section (Johnson et al. 1985a, Hansel et al. 1987; Johnson and Hansel 1990), where the basal sand and gravel was included with laminated clay and silt as part of the Peddicord Formation (interpreted to be proglacial sediment associated with the Lake Michigan Lobe advance during the Michigan Subepisode). In this revision we are treating the bedded, sorted sediment that interfingers with the diamicton formations of the Wedron Group as tongues of the sorted-sediment units; therefore, the former Ashmore Member is classified in this report with the Henry Formation of the Mason Group rather than with the Wedron Group (fig. 9b). As redefined, the Ashmore Tongue includes only the bedded, sorted sediment that is coarse grained (predominantly sand and gravel); the fine textured facies (predominantly silt and clay) of the original Ashmore Member is classified herein as the Peddicord Tongue of the Equality Formation.

Description

The Ashmore Tongue consists of fingers and lentils of medium to coarse textured, stratified sediment, predominantly sand and gravel, that are overlain by diamicton of the basal part of the Tiskilwa Formation; the upper part of the sequence may contain intercalated diamicton lenses and tongues. Detrital organic matter is sometimes found within the stratified sediment. The pebble and carbonate composition of the Ashmore Tongue is similar to that of Tiskilwa Formation diamicton.

Boundaries

Lower boundary: the contact with the Peddicord Tongue (Equality Formation), the Morton Tongue (Peoria Silt), the Robein Member (Roxana Silt), or older units. Upper boundary: the contact with Peddicord or Morton Tongues, diamicton of the Delavan Member, or undivided Tiskilwa Formation.

Differentiation from other units

The stratified sequence of the Ashmore Tongue is generally readily distinguishable from both the nonbedded silt of the Morton Tongue (Peoria Silt) and the more organic, leached, stratified silt of the Robein Member (Roxana Silt). The contact of the coarser grained Ashmore Tongue with the finer grained Peddicord Tongue is sometimes gradational and/or interfingered. The stratified Ashmore Tongue can generally be readily differentiated from massive diamicton of Tiskilwa Formation, but in places the stratified sediment contains diamicton lenses and beds. In such places an erosional contact often occurs at the base of the more massive diamicton of the Tiskilwa Formation and serves to separate the Ashmore Tongue, which may contain interbeds of diamicton in its upper part.

Regional extent and thickness
The Ashmore Tongue is present as a discontinuous subsurface unit at the base of the Tiskilwa Formation in the Harvard, Princeton, Peoria, and Decatur Sublobe areas of Illinois. It is up to 10 meters (33 ft) thick in some areas.

Origin
The Ashmore Tongue is the basal fluvial facies of a glacigenic sequence that contains Tiskilwa Formation. The proglacial facies might include for example a coarsening-upward succession interpreted to be loess (Morton Tongue), glaciolacustrine clay and silt (Peddicord Tongue), and glaciofluvial sand and gravel (Ashmore Tongue) that is overlain by ice-marginal redeposited sediment and till of the undivided Tiskilwa Formation or the Delavan Member.

Age and correlation
The Ashmore Tongue was deposited as the Tiskilwa ice margin advanced to its maximum position first in the Harvard Sublobe area (Marengo Moraine) and later in the Princeton, Peoria, and Decatur Sublobe areas (outer moraines of the Bloomington and Shelbyville Morainic Systems) between about 26,000 and 19,500 radiocarbon years ago (figs. 9, 13). It correlates with equivalent Henry Formation beyond the outer Wedron Group boundary, the lower stratified part of the Tiskilwa Member of the Zenda Formation in Wisconsin (Mickelson et al. 1984), and part of the Atherton Formation in Indiana (Wayne 1963).

Beverly Tongue

Status
New unit. Includes sand and gravel formally classified as part of the Haeger Till Member.

Source of name	Beverly Sand and Gravel Pit, northeastern Illinois.
Original name	This report.
Type section	Beverly Sand and Gravel Pit, a large pit in Kane and Cook Counties about 3.3 kilometers (2 mi) east of state highway 25 and Interstate 90 intersection northeast of Elgin; good for lithology and upper boundary (fig. 19).

Definition
The Beverly Tongue is the stratified sand and gravel of the Henry Formation that extends beneath the Haeger Member diamicton of the Lemont Formation. In places it is interfingered with fine grained sediment of the Equality Formation and/or diamicton of the Haeger Member.

Background
Proglacial sand and gravel below Haeger Member diamicton is classified in this report as a formal unit of the Henry Formation (fig. 9b). It is a thick (up to 30 m [98 ft]), laterally extensive sand and gravel deposit that is an important aggregate resource and aquifer in parts of McHenry, Lake, Kane, and Cook Counties in northeastern Illinois. Beyond the boundary of the Haeger Member, this sand and gravel is continuous at the surface with the Henry Formation deposited in a bouldery and cobbly outwash plain along the front of the Woodstock and West Chicago Moraines in McHenry, Kane, and Du Page Counties (Masters 1978). In places along the front of the West Chicago Moraine in Du Page County, the Beverly Tongue underlies clayey diamicton of the Wadsworth Formation (Hansel and Johnson 1987).

Description
The Beverly Tongue consists of fingers and lentils of medium to coarse grained, stratified sediment that underlies the Haeger Member diamicton of the Lemont Formation, or less commonly diamicton of the Wadsworth Formation. Regionally, the sucession of deposits in the Beverly Tongue is a coarsening-upward sequence of sand and gravel, which may contain intercalated diamicton lenses and tongues. Cobble to boulder gravel is common in the upper part of the sequence and is similar lithologically to the Haeger Member. The gravel contains about 90% sedimentary rocks, about 75% of which is dolomite, and about 10% igneous and metamorphic rocks (Hansel et al. 1985a).

Boundaries
Lower boundary: the contact with a tongue of the Equality Formation, the Yorkville Member (Lemont Formation), the Tiskilwa Formation, or older units. Upper boundary: the Haeger Member of the Lemont Formation or the Wadsworth Formation.

Differentiation from other units
The stratified sequence of the Beverly Tongue is often gradational and/or interfingered with a finer grained tongue of the Equality Formation. Where underlain by older diamicton units, the lower contact of the Beverly Tongue is readily distinguishable. Although the stratified sediment of the Beverly Tongue may contain diamicton beds in its upper part, an erosional contact is generally present at the base of the more massive Haeger diamicton, and it can be used to separate the two units.

Regional extent and thickness
The Beverly Tongue of the Henry Formation is a fairly continuous subsurface unit at the base of the Haeger Member in the Harvard Sublobe area in northeastern Illinois. It is up to about 30 meters (98 ft) thick.

Origin
The Beverly Tongue is the proglacial fluvial facies of a glacigenic sequence that includes subglacial till of the Haeger Member. Regionally, the proglacial sequence includes distal fine grained lacustrine and fluvial sediment (Equality Formation tongue) and medial and proximal sand and gravel (Beverly Tongue), which is overlain by diamicton of sediment flow and subglacial origin of the Haeger Member (Cobb and Fraser 1981, Fraser and Cobb 1982, Hansel and Johnson 1987).

Age and correlation

The Beverly Tongue was deposited as the Haeger ice margin advanced to the Woodstock Moraine in the Harvard Sublobe area during the early part of the Woodstock Phase of the Michigan Subepisode, probably between about 16,500 and 16,000 radiocarbon years ago (Hansel and Johnson 1992; fig. 10). It correlates with an unnamed tongue of the Henry Formation in the Joliet Sublobe area and the basal sand and gravel unit of the New Berlin Member of the Holy Hill Formation in Wisconsin (Mickelson et al. 1984, Mickelson and Syverson, in press).

Equality Formation

Status

Redescribed unit. Formation redescribed to remove lithogenetic concepts from its definition and recognized as intertonguing with diamicton units of the Wedron Group as well as other sorted-sediment units of the Mason Group; former Lake Michigan Formation lowered in rank to member of unit; former Peddicord Formation recognized as a formal tongue of unit.

Source of name Equality, a village in Gallatin County, southeastern Illinois.

Original name Equality Formation (Willman and Frye 1970).

Type section Saline River Section, an exposure at a bridge excavation site, 4 miles (6.4 km) southwest of Equality; no longer exposed.

Principal reference sections

Core 9V, Lake Michigan; good for lithology and lower boundaries of Lake Michigan Member and undivided formation. Wedron and Charleston Sections; good for boundaries and lithology of Peddicord Tongue (figs. 12, 15).

Definition

The Equality Formation consists of gray to red silt and clay, generally shows evidence of bedding structures, and occurs above the Sangamon Geosol. It intertongues with diamicton units of the Wedron Group, other formations of the Mason Group, particularly the Henry Formation, and some surficial units. Beneath Lake Michigan, the upper, gray part of the Equality Formation that is above the Chippewa unconformity and/or red clay and silt of the undivided formation is recognized as the Lake Michigan Member. The lower tongue of the formation that extends beneath the Delavan Member or undivided Tiskilwa Formation is recognized as the Peddicord Tongue.

Background

The Equality Formation was defined by Willman and Frye (1970) to include lake sediment that occurs at the surface or underlies loess or Holocene deposits. Tongues of equivalent lake sediment interfingered with till units of the Wedron and Winnebago Formations were separated from the Equality Formation by vertical boundaries and classified as part of the till units (fig. 3). In addition to deposits of ice-contact, kettle, and proglacial lakes, Willman and Frye (1970) also included deposits of large slackwater lakes in back-flooded valleys tributary to the major meltwater drainageways in the formation. They classified similar fine grained deposits that occur stratigraphically below the Sangamon Geosol as the Teneriff Silt (Illinoian Stage).

Willman and Frye (1970) divided the Equality Formation into two members, the Carmi and Dolton, which constitute sedimentary facies. They included the relatively deep-water, finer grained sediment consisting predominantly of silt and clay in the Carmi Member and the near-shore, coarser grained sediment consisting predominantly of sand and gravel in the Dolton Member. The members are not differentiated where neither type of sediment dominates.

In this report, the Equality Formation is redescribed to (1) exclude genetic criteria from its definition, (2) include laterally equivalent tongues of sediment that interfinger with diamicton units of the Wedron Group or other sorted-sediment units of the Mason Group, and (3) include laminated red and gray clay beneath Lake Michigan that formerly was classified as the Lake Michigan Formation. As redescribed, the Equality Formation consists of relatively fine grained, stratified sediment of predominantly silt and clay, overlies the Sangamon Geosol, and intertongues with units of the Wedron and Mason Groups or surficial units (fig. 9c). The redescription excludes the coarser grained Dolton Member (Willman and Frye 1970) as part of the Equality Formation. Instead, the stratified sand and gravel formerly classified as the Dolton Member is included in the Henry Formation as an informal facies to which the name "Dolton" is applied. When the Equality Formation is restricted to the finer grained facies, it is similar in concept to the Carmi Member; therefore, the latter name is abandoned.

Two former formations, the Lake Michigan (Willman and Frye 1970) and the Peddicord (Willman et al. 1971), are classified as part of the Equality Formation: the former as a member and the latter as a tongue. On the basis of seismic profiles and 55 cores collected from the southern two-thirds of Lake Michigan, Colman and Foster (1990), Foster and Colman (1991), and Colman et al. (1994) found that the laminated red clay of the lower Lake Michigan Formation grades laterally into stratified diamicton and sorted sediment interfingered with more massive diamicton tongues of the Wedron Group. They concluded that the lower red part of the former Lake Michigan Formation was a distal facies of the more ice-proximal stratified sediment of the Equality Formation. Herein, the upper gray to brown part of the former Lake Michigan Formation is classified as the Lake Michigan Member of the Equality Formation, whereas the underlying red laminated sediment, which Colman and Foster found to be separated from the upper part by a gradational contact in deep basins or the Chippewa unconformity in shallow water, is classified as undivided Equality Formation.

Originally (Willman et. al. 1971), the Peddicord Formation was defined to include gray and pink silt that had accumulated in a lake confined to the buried Ticona drainage system. Because Willman et al. (1971) correlated organic-rich silt above the gray and pink silt of the Peddicord Formation with the Robein Silt of the Farmdalian Substage in the type area (Morris North Section), they also classified the Peddicord Formation as part of the Farmdalian Substage. New exposures at Wedron, the type section of the Peddicord Formation, indicate the above correlation was in error (Johnson et al. 1985a); the laminated silt and clay facies classified as the Peddicord Formation stratigraphically overlies the Robein Silt (fig. 12 [herein classified as the Robein Member of the Roxana Silt]). In the type area, the Peddicord silt and clay is similar in clay-mineral composition to diamicton of the Tiskilwa Formation.

The fine grained stratified sequence found in the buried Ticona drainage system near Wedron is in the same stratigraphic position as similar sediment that occurs predominantly in buried bedrock valleys or other low places in the pre-Michigan Subepisode landscape. Where this laminated silt and clay unit extends as a tongue beneath the Tiskilwa Formation, it is classified as the Peddicord Tongue of the Equality Formation (fig. 9c).

Description
The Equality Formation consists predominantly of brown to gray to red bedded silt and clay (fig. 31) that is similar in lithology to the silt- and clay-size fractions of diamicton units of the Wedron Group. Lonestones (isolated stones) and lenses of gravel, sand, diamicton, organic debris, and wood are present locally in the silt and clay. Bedding structures in the unit range from distinct rhythmites to fine indistinct laminae to more massive beds that locally contain lonestones but exhibit little apparent bedding.

Boundaries
Lower boundary: the contact with tongues of the Wedron Group, Peoria Silt, Henry and Roxana Formations, or the Loveland Silt, Pearl, Glasford, and Winnebago Formations, or older units. Upper boundary: the contact with the Wedron Group, Peoria Silt, and Henry Formation, or other units. The contact with the Henry Formation is commonly gradational and/or interfingered.

Differentiation from other units
Where the Equality Formation contains distinct bedding structures, it is readily distinguishable from the more massive diamicton units of the Wedron Group and Winnebago and Glasford Formations. Where bedding structures are less apparent, the Equality Formation is sometimes similar to the finer grained diamicton units (e. g., the Yorkville Member of the Lemont Formation and the Wadsworth and Kewaunee Formations), but it is usually softer and better sorted. Although its contacts are sometimes gradational and interfingered, the Equality Formation is generally distinct from deposits of the other Mason Group formations, which are coarser grained or lack bedding structures. The presence of the Sangamon Geosol in the upper part of the Teneriffe and Loveland Silts and the Pearl Formation helps to distinguish these older sorted-sediment units from the Equality Formation.

Regional extent and thickness
Like the Henry Formation, the Equality Formation is present in nearly all of the counties inundated by the Lake Michigan Lobe during the Michigan Subepisode, but its distribution is patchy and discontinuous (plate 1). It is most extensive (1) beneath Lake Michigan, (2) beneath plains between end moraines or adjacent to Lake Michigan in northeastern Illinois, and (3) in low-lying plains adjacent to and in tributaries of the Wabash, Ohio, and Mississippi Rivers in southern Illinois and the Green and Illinois Rivers in western Illinois. In the subsurface, tongues and lenses of the Equality Formation are present in some buried valleys and basins; they tend to pinch out in the up-ice direction beneath the Henry Formation or diamicton units of the Wedron Group. Locally, the Equality Formation is interfingered with or grades into the Henry Formation. The Equality Formation is extremely variable in thickness. Willman and Frye (1970) reported thicknesses ranging from less than 2 meters (6.6 ft) to more than 20 meters (65.6 ft) for the Equality Formation (former Carmi Member), but it is much thicker beneath Lake Michigan, where Foster and Colman (1991) infer thicknesses (i. e., the combined thickness of the former Equality and Lake Michigan Formations) greater than 50 meters (164 ft) in seismic profiles.

Origin
The Equality Formation is interpreted to be predominantly fine grained lacustrine sediment deposited in glacial and postglacial lakes. The sediment of former proglacial lakes records ice-distal and ice-proximal facies, and in some cases the rhythmites may reflect annual couplets (varves). These deposits in lakes and former lakes record the glacial to postglacial transition.

Age and correlation
The Equality Formation was deposited during the Wisconsin and Hudson Episodes. Most of it probably ranges from about 26,000 radiocarbon years to modern, although some of it is older (appendix B2). It correlates with part of the Atherton and Martinsville Formations in Indiana (Wayne 1963) and unnamed units in Wisconsin, Michigan, Iowa, and Missouri.

Peddicord Tongue

Status
Revised unit. Formation lowered in rank and redefined as the Peddicord Tongue of the Equality Formation.

Source of name Peddicord School in La Salle County, northeastern Illinois.

Original name Peddicord Formation (Willman et al. 1971).

Type section Wedron Section (fig. 12), Wedron Silica Company quarries at Wedron, Illinois; good for contacts and lithology.

Principal reference section
Charleston Section (figs. 15, 32), Charleston Stone Quarry pits; good for boundaries and lithology.

Definition
The Peddicord Tongue is the stratified silt and clay of the Equality Formation that extends beneath the basal red gray diamicton unit of the Tiskilwa Formation or gray diamicton unit of the Delavan Member of the Tiskilwa Formation. In places it is interfingered with other units of the Mason Group, for example, the Ashmore Tongue (Henry Formation) or the Morton Tongue (Peoria Silt).

Background

Fine grained, laminated sediment below the pink Tiskilwa till of the Bloomington Morainic System occurs at many places along the Illinois Valley between La Salle and Morris (Willman et al. 1971). The laminated sediment, which commonly consists of thin silty clay beds separated by thin laminae of coarse silt or sand, was referred to as the "Kickapoo beds" (Sauer 1916) and later as the "Lake Kickapoo deposits" (Willman and Payne 1942). The lacustrine sediment was included in the Shelbyville drift and interpreted to have formed in the Ticona Valley after the valley was dammed at Peoria during and after formation of the Shelbyville Moraine (Willman and Payne 1942). Restudy of stratigraphic relationships at the Wedron Section by Leonard and Frye (1960), however, showed a gray till, which Willman and Frye later (1970) correlated to the Lee Center Till Member (formerly Shelbyville drift), beneath the pink till of the Tiskilwa Till Member (formerly Bloomington drift). Beneath the gray till, Willman and Frye (1970) described 6 meters (20 ft) of massive to indistinctly bedded, pink clayey silt overlying 7.6 meters (25 ft) of massive blue gray to tan silt. Both the pink and the gray silts locally contain wood fragments, and the gray silt contains molluscan fauna. The radiocarbon ages for wood from the pink and gray silt beds at Wedron (24,000 and 26,800 years before present, respectively) led Willman and Frye (1970) to classify the silt beds with the Robein Silt (Farmdalian Substage). Because of the lithologic similarity and common age of the silt beds at Wedron with those at the Morris North Section, and the dissimilarity of the silt beds at the two sections with the more massive organic-rich, often peaty, Robein Silt, Willman et al. (1971) later established a new formation (named Peddicord) for fine grained, generally laminated, sediment that occurs stratigraphically beneath the basal gray Woodfordian till (Lee Center Member, Wedron Formation) and above the Robein Silt. Willman et al. (1971) attributed the Peddicord Formation to deposition in a lake that formed in the buried Ticona Valley during late Altonian and early Farmdalian time. They suggested this Lake Peddicord might have formed in response to the damming of the Ticona Valley by Altonian drift to the west. Willman et al. (1971) believed that the Peddicord Formation was older than the "Lake Kickapoo deposits," but they recognized that some of the latter deposits may have been misclassified and actually belong to the Peddicord Formation.

In the early 1980s, new excavations and interpretations in pit 1 at the Wedron Section (Johnson et al. 1985a) indicated the soil below the Peddicord Formation was the Farmdale Soil rather than the Sangamon Soil and the basal gray till of the Wedron Formation was not correlative with the Lee Center Till Member, now attributed to the Illinois Episode (Berg et al. 1985). The basal gray till was interpreted instead to have been deposited during the advance of the Tiskilwa ice to the Bloomington Morainic System. As a result of these new interpretations, Johnson et al. (1985a) classified the Peddicord Formation with the Woodfordian Substage. They broadened the concept of the Peddicord Formation to include the overlying well sorted, coarse to fine sand containing gravel beds that are up to 6 meters (20 ft) thick at Wedron. The sand was interpreted to be proglacial fluvial sediment that overlies the alluvial and lacustrine silt beds. Both the silt and sand facies were included in the lower glacigenic sequence (Johnson and Hansel 1990) at Wedron; the proglacial depositional environment was interpreted to have changed from alluvial to glaciolacustrine to glaciofluvial as the Tiskilwa ice margin advanced in northern Illinois and the drainage system in the Ticona Valley was dammed by the ice margin or by outwash from that event.

In this report the Peddicord Formation is decreased in rank to the Peddicord Tongue of the Equality Formation (fig. 9c). The Peddicord Tongue consists of fine grained laminated sediment that extends beneath the undivided Tiskilwa Formation, the Delavan Member (Tiskilwa Formation), or the Ashmore Tongue (Henry Formation). The concept of the Peddicord Tongue is extended to include other laminated sand, silt, and clay at this same stratigraphic position elsewhere in Illinois; thus, the Peddicord deposits are no longer confined to the Ticona Valley. The sand facies of the Peddicord Formation at Wedron, as modified by Johnson et al. (1985), is classified with the Ashmore Tongue of the Henry Formation.

Description

The Peddicord Tongue consists of tongues and lentils of fine textured stratified sediment, predominantly silt and clay, that are overlain by diamicton of the Tiskilwa Formation or the Morton (Peoria Silt) or Ashmore (Henry Formation) Tongues. Detrital organic matter and in situ wood are sometimes found within the stratified sediment. The clay-mineral, pebble, and carbonate compositions of the Peddicord Tongue are similar to those of the Tiskilwa Formation diamicton.

Boundaries

Lower boundary: the contact with the Morton (Peoria Silt) or Ashmore (Henry Formation) Tongues, the Robein (Roxana Silt) Member, or older units. Upper boundary: the contact with the Ashmore or Morton Tongues, the Delavan Member, or undivided Tiskilwa Formation.

Differentiation from other units

The laminated Peddicord Tongue is generally readily distinguishable from the nonbedded silt of the Morton Tongue and the more organic, leached, stratified silt of the Robein Member. The contact of the Peddicord Tongue with the coarser grained Ashmore Tongue is sometimes gradational and/or interfingered. The Peddicord Tongue generally shows some evidence of bedding, whereas diamicton of the Tiskilwa Formation is more massive in appearance, although each unit can contain lenses of sediment similar to that of the other.

Regional extent and thickness

The Peddicord Tongue is a discontinuous subsurface unit found in some low-lying parts (e. g., valleys and basins) of the pre-Michigan Subepisode landscape beneath the Ashmore Member and/or the Tiskilwa Formation. It can potentially occur wherever the Tiskilwa Formation is mapped in the Harvard, Princeton, Peoria, and Decatur Sublobe areas of Illinois. The Peddicord Tongue is up to about 10 meters (33 ft) thick.

Origin

The Peddicord Tongue is the basal low-energy lacustrine facies of a glacigenic sequence that contains Tiskilwa Formation. The proglacial sequence might, for example, include a coarsening-upward succession consisting of loess (Morton Tongue), lacustrine clay and silt (Peddicord Tongue), and near shore and fluvial sand and gravel (Ashmore Tongue) that is overlain by ice-marginal redeposited sediment and till of the Tiskilwa Formation.

Age and correlation
The Peddicord Tongue was deposited as the Tiskilwa ice margin advanced to its maximum position first in the Harvard Sublobe area (Marengo Moraine) and later in the Princeton, Peoria, and Decatur Sublobe areas (outer moraines of the Bloomington and Shelbyville Morainic Systems) between about 26,000 and 19,500 radiocarbon years ago (figs. 10,13). It correlates with equivalent Equality Formation beyond the outer margin of the Wedron Group boundary, the lower, fine grained stratified part of the Tiskilwa Member of the Zenda Formation in Wisconsin (Mickelson et al. 1984), and part of the Atherton Formation in Indiana (Wayne 1963).

Lake Michigan Member

Status
Revised unit. Redefined to include only the upper, gray, fine grained laminated sediment of the former Lake Michigan Formation of Willman and Frye (1970) and lowered in rank to a member of the Equality Formation; members defined by Willman and Frye (1970) and Lineback et al. (1970) are abandoned as formal lithostratigraphic units; unit is not recognized outside the Lake Michigan basin.

Source of name Lake Michigan.

Original name Lake Michigan Formation (Willman and Frye 1970).

Type section Southern Lake Michigan cross section; cores 112, 116, 117, 118, 143, 144, 145, 146, 147, and 148 taken 20 to 32 kilometers (12.5–20 mi) east of Waukegan, Illinois; good for lithology and lower contact.

Principal reference sections
Cores 5p and 9v; both good for lithology of member and boundary with undivided formation.

Definition
The Lake Michigan Member of the Equality Formation consists of the uppermost gray to brown laminated silt and clay that occurs above the Chippewa unconformity in shallow water and above a redder laminated silt and clay unit in the deep bathymetric basins beneath Lake Michigan.

Background
The Lake Michigan Formation was defined by Willman and Frye in 1970 to include the lacustrine deposits of modern lakes. Although present in most existing natural lakes, lacustrine deposits are most evident in Lake Michigan. Willman and Frye recognized the modern beach sand as the Ravinia Sand Member of the Lake Michigan Formation; they left further differentiation of the formation to other ISGS scientists, who were studying the stratigraphy beneath Lake Michigan at the same time. Thus, Lineback et al. (1970) defined, on the basis of 22 cores taken from the bottom sediments of southern Lake Michigan, five additional members in the Lake Michigan Formation. In ascending order, they are the South Haven, Sheboygan, Winnetka, Lake Forest, and Waukegan Members (fig. 9c). They were differentiated on the basis of changes in color, water content, cohesiveness, grain size, and mineralogy. The lower two members are reddish; the Sheboygan Member contains the Wilmette Bed (also defined by Lineback et al. 1970), a distinct dark clay bed that is widespread in the southern Lake Michigan basin where the water is more than 82 meters (269 ft) deep. The upper three members of the Lake Michigan Formation are dark gray to dark brown and successively coarser and darker upward. They contain thin, black beds and dark mottling.

The members of the Lake Michigan Formation were also differentiated by Lineback et al. (1974) in 50 additional cores from Lake Michigan, some of which were from the central and northern parts of the lake. Lineback et al. (1974) and Wickham et al. (1978) suggested the Carmi Member of the Equality Formation, which commonly underlies the Lake Michigan Formation and overlies the till members in the lake basin, was late glacial and the Lake Michigan Formation was postglacial.

In 55 cores collected from the southern two-thirds of Lake Michigan in 1988 and 1989, Colman and Foster (1990) were unable to consistently distinguish between the two red members nor among the three gray brown members of the Lake Michigan Formation described by Lineback et al. (1970) and Wickham et al. (1978). Instead, they informally grouped the red members into the lower Lake Michigan Formation and the gray brown members into the upper Lake Michigan Formation (fig. 9c). The two informal members are separated by the Chippewa unconformity (Hough 1955) in relatively shallow water and by a gradational color change in deeper water. Like Lineback et al. (1970, 1974), Colman and Foster (1990) recognized the Wilmette Bed in the lower Lake Michigan Formation. They attributed the thin black beds (hydrous iron monosulfides), which are most prevalent in the upper Lake Michigan Formation but are also present in the lower Lake Michigan Formation, particularly in the Wilmette Bed, to diagenesis associated with reducing conditions caused by decaying organic matter. Furthermore, Colman and Foster (1990), Foster and Colman (1991), and Colman et al. (1994) found that the laminated red clay of the lower Lake Michigan Formation, when traced on seismic profiles, graded laterally into stratified diamicton and sorted sediment interfingered with more massive diamicton tongues. On the basis of such relationships, they interpreted the lower Lake Michigan Formation to be a distal facies of the more ice-proximal stratified sediment of the Equality Formation and, therefore, to be part of the glacial sequence rather than the postglacial sequence. They concluded that the Chippewa unconformity, which truncates the lower Lake Michigan Formation on basin slopes and older units in the nearshore zone, marks the boundary between the glacial and postglacial sedimentary sequences and also roughly coincides with the Pleistocene-Holocene boundary. Foster and Colman (1991) suggested that the nomenclature and rank of lithostratigraphic units in the Lake Michigan basin established by Lineback et al. (1970) was inappropriate and could be replaced with two formations corresponding to the glacial and postglacial seismic sequences.

In this report, we chose to include in the Equality Formation all the fine grained, bedded sediment that underlies, interfingers with, or overlies the Wedron Group. The gray to brown, laminated clay and silt, which was classified as the upper Lake Michigan Formation by Foster and Colman (1991) and the Winnetka, Lake Forest, and Waukegan Members of the Lake Michigan Formation by Lineback et al. (1970), is reclassified in this report as the

Lake Michigan Member of the Equality Formation (fig. 9c). We recommend that the Lake Michigan Member is appropriate only in the Lake Michigan basin and that the members and bed of the former Lake Michigan Formation be abandoned as formal lithostratigraphic units and used instead as informal units where they can be differentiated. The coarser grained sediment of the former Ravinia Sand Member is herein classified with the Dolton facies of the Henry Formation.

Description
The Lake Michigan Member consists of gray to brown, laminated clay and silt, and overlies red, laminated clay and silt of the undivided Equality Formation in the Lake Michigan basin. Although it is separated from the formation and older units by the Chippewa unconformity in shallow water, its contact with the formation is conformable and gradational in the deep basins (Foster and Colman 1991). Locally, the Lake Michigan Member contains lenses of sand, gravel, and organic debris.

Boundaries
Lower boundary: the truncational contact with undivided Equality Formation on the basin slopes or older units in the nearshore zone and the conformable and gradational contact with red, laminated sediment in the deep basins. Upper boundary: the floor of Lake Michigan or the contact with tongues of the Henry Formation (Dolton facies) in the nearshore zone.

Differentiation from other units
On the flanks and slopes of the basins beneath Lake Michigan, the Lake Michigan Member is readily differentiated from the diamicton units and undivided Equality Formation by the Chippewa unconformity, which is evident in both seismic profiles and cores. In the deep basins where the Chippewa unconformity is absent, differentiation of the Lake Michigan Member from the rest of the formation is marked only by the transition zone between the lower red and upper gray clay.

Regional extent and thickness
The Lake Michigan Member forms the lake floor beneath Lake Michigan except in areas of erosion or nondeposition, mostly along the southwestern shoreline and on the mid-lake high (Lineback et al. 1970, Wickham et al. 1978, Foster and Colman 1992). On the basis of seismic profiles and cores, Foster and Colman (1992) mapped thicknesses greater than 14 meters (46 ft; 20 m [65.5 ft] maximum). Like Lineback et al. (1970), they show an asymmetric distribution beneath the deep basins, marginal slopes, and nearshore zone of the lake. The Lake Michigan Member is thickest in three lobes along the east side of the lake, two lobes in the southern basin, and another lobe in the eastern mid-lake basin; it generally tends to pinch out in the nearshore zones.

Origin
The Lake Michigan Member is interpreted to be postglacial lake sediment derived primarily from coastal erosion and sediment supplied by rivers flowing into Lake Michigan. The latter is likely responsible for the thick sediment wedges along the east side of the lake (Lineback et al. 1971, Foster and Colman 1992).

Age and correlation
The Lake Michigan Member is postglacial (Hudson Episode) and postdates the Chippewa low lake level, which resulted from the deglaciation of the isostatically depressed northern outlet at North Bay, Ontario, about 10,300 radiocarbon years ago (Larsen 1987); the member dates from postglacial to modern (appendix B2). The Lake Michigan Member replaces the gray and brown clay of the Winnetka, Lake Forest, and Waukegan Members of Lineback et al. (1970) and the upper Lake Michigan Formation of Foster and Colman (1991, 1992; fig. 9c); it is time correlative with the upper part of the Equality Formation in other parts of Illinois and unnamed units beneath adjacent Great Lakes in other states and provinces.

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APPENDIXES

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Explaination of nomenclature used in appendixes

Appendix A

Type of Data

GS	grain size
MGS	matrix grain size
CM	clay mineral
CC	Chittick carbonate
CA	chemical
PL	pebble lithology
HM	heavy mineral
LM	light mineral
E	engineering
MS	magnetic susceptibility
SL	coarse sand lithology
P	pollen
OC	organic carbon

Survey Publications

Illinois State Geological Survey

B	Bulletin
C	Circular
EG	Environmental Geology
EGN	Environmental Geology Note
G	Guidebook
R	Reprint
RI	Report of Investigation

Wisconsin Geological & Natural History Survey

GW	Geoscience Wisconsin
MP	Miscellaneous Paper
IC	Information Circular

Indiana Geological Survey

OP	Occasional Paper

Appendixes A, B1, B2

F	formation
M	member
TM	till member
L	loess
T	tongue

APPENDIX A
Sources and Types of Analytical Data for Lithostratigraphic Units of the Mason and Wedron Groups

Unit (Original name)	Area, county, or section	Type of data	Publication and/or reference
Roxana Silt, undivided			
(Roxana Silt)	Mississippi, Iowa, Wabash, and Ohio River Valleys	CM, HM, LM, CA	C334, Frye et al. 1962
(Roxana Silt)	Illinois, Mississippi, Ohio, and Wabash River Valleys	CM, HM, LM	B94, Willman and Frye 1970
(Roxana Silt)	Center School Sec.	GS, CM, HM, CA	G9, Johnson et al. 1972
(Roxana Silt)	Hutton Sec.	GS, CM	G9, Johnson et al. 1972
(Roxana Silt)	Collison Branch Sec.	GS, CM, HM, CA	G9, Johnson et al. 1972
(Roxana Silt)	Farm Creek Sec.	GS, CM, CC	G13, Follmer et al. 1979 G21, McKay 1986b Follmer and McKay 1987
(Roxana Silt)	Gardena Sec.	GS, CM, CC	G13, Follmer et al. 1979 G21, McKay 1986b Follmer and McKay 1987
(Roxana Silt)	Glendale School Sec.	GS, CM, CC	G13, Follmer et al. 1979
(Roxana Silt)	Graybar Sec.	GS, CM, CC	G13, Follmer et al. 1979
(Roxana Silt)	Arenzville Sec.	CM, CC	G13, Follmer et al. 1979
(Roxana Silt)	Fairground Sec.	GS, CM, CC	G13, Follmer et al. 1979
(Roxana Silt)	Athens Quarry Sec.	GS, CM, CC	G13, Follmer et al. 1979 G21, McKay 1986b
(Roxana Silt)	Core G39, Madison Co.	CC	G13, McKay 1979b
(Roxana Silt)	Wempletown Southeast Sec.	GS, CM	G19, McKenna and Follmer 1985
Roxana Silt, Robein Member			
(Farmdale Silt)	Illinois River Valley	CM, HM, LM, CA	C334, Frye et al. 1962
(Robein Silt)	Illinois	CM, HM, LM	B94, Willman and Frye 1970
(Robein Silt)	Farm Creek Sec.	GS, CM, CA	G13, Follmer et al. 1979 G21, McKay 1986b Follmer and McKay 1987
(Robein Silt)	Gardena Sec.	GS, CM, CC	G13, Follmer et al. 1979 G21, McKay 1986b Follmer and McKay 1987
(Robein Silt)	Wedron Sec.	GS, CM	G16, Johnson et al. 1985a
(Robein Silt)	ISGS test-hole S-30, Kane Co.	GS, OC	R1989P, Curry 1989 Curry and Follmer 1992
(Robein Silt)	Lomax Sec.	GS	Curry and Follmer 1992
Peoria Silt, undivided			
(Peoria L)	Illinois, Mississippi, Wabash, and Ohio River Valleys	CM, HM, LM, CA	C334, Frye et al. 1962
(Peoria L)	Illinois, Mississippi, Rock, Ohio, and Wabash River Valleys	CM, HM, LM	B94, Willman and Frye 1970
(Peoria L)	Hutton Sec.	GS, CM	G9, Johnson et al. 1972
(Peoria L)	Arenzille Sec.	CM, CC	G13, Follmer et al. 1979
(Peoria L)	Fairground Sec.	GS, CM, CC	G13, Follmer et al. 1979
(Peoria L)	Athens Quarry Sec.	GS, CM, CC, P	G13, Follmer et al. 1979 G21, McKay 1986b
(Peoria L)	Jubilee College Sec.	CM	G13, Follmer et al. 1979

Unit (Original name)	Area, county, or section	Type of data	Publication and/or reference
Peoria Silt, undivided *(cont)*			
(Peoria L)	Core G39, Madison Co.	CC	G13, McKay 1979b G14, McKay 1979a G23, McKay 1986a
(Peoria L)	Maryville area	GS, CM, CC	G14, McKay 1979a G23, McKay 1986a
(Peoria L)	Canteen Creek Sec.	GS, CM, CC	G14, McKay 1979a
(Peoria L)	Harkness Creek Sec.	GS, CM	G14, Wickham 1979b
(Peoria L)	Wempleton Southeast Sec.	GS, CM	G19, McKenna and Follmer 1985
(Peoria L)	Pancake Hollow Sec.	GS, CM	G23, Hajic 1986
(Peoria L)	Green Bay Hollow Sec., Pancake Hollow Sec.	MS	Grimley 1991a, b
(Peoria L)	ISGS test-hole S-30, Kane Co.	GS, CM	Curry and Follmer 1992
(Peoria L)	Lomax Sec.	GS	Curry and Follmer 1992
(Richland L)	Illinois and Mississippi River Valleys	CM, HM, LM	C334, Frye et al. 1962
(Richland L)	Northeastern IL	CM, HM, LM	B94, Willman and Frye 1970
(Richland L)	Farm Creek Sec.	GS, CM, CC	G13, Follmer et al. 1979 G21, McKay 1986b Follmer and McKay 1987
(Richland L)	Beverly Sec.	GS, CM	G16, Hansel et al. 1985b
Peoria Silt, Morton Tongue			
(Morton L)	De Witt, Tazewell, Woodford Co.	CM, HM, LM, CA	C334, Frye et al. 1962
(Morton L)	Northeastern IL	MGS, CM, HM, LM	B94, Willman and Frye 1970
(Morton L)	Shelbyville, IL	GS, CM, CC	C459, Johnson et al. 1971a
(Morton L)	Farm Creek Sec.	GS, CM, CC	G13, Follmer et al. 1979 G21, McKay 1986b Follmer and McKay 1987
(Morton L)	Gardena Sec.	GS, CM, CC	G13, Follmer et al. 1979 Follmer and McKay 1987
(Morton L)	Glendale School Sec.	GS, CM, CC	G13, Follmer et al. 1979
(Morton L)	Graybar Sec.	GS, CM, CC	G13, Follmer et al. 1979
(Morton L)	Wedron Sec.	GS, CM	G16, Johnson et al. 1985a
Equality Formation			
(unit 8)	Lake Michigan	GS, CM	EGN30, Gross et al. 1970
(Carmi M)	Lake Michigan	GS, CM	EGN84, Wickham et al. 1978
Equality Formation, Peddicord Tongue			
(Peddicord F)	Wedron Sec.	GS, CM	G16, Johnson et al. 1985a
(Peddicord F)	Kane Co.	GS, E	EGN120, Kempton et al. 1987a
(Peddicord F)	Kendall Co.	GS, E	EGN122, Curry et al. 1988
(Peddicord F, facies A1)	Wedron, IL	GS, CM	R1990B, Johnson and Hansel 1990
Equality Formation, Lake Michigan Member			
(units 1-7)	Lake Michigan	GS, CM	EGN30, Gross et al. 1970
(Lake Michigan F., by member)	Lake Michigan	GS, CM	EGN84, Wickham et al. 1978
Tiskilwa Formation, undivided			
(unit E)	central northern IL	GS, CM	C356, Kempton 1963
(Marengo till)	McHenry Co.	GS, CM, E	EGN19, Smith 1968

Unit (Original name)	Area, county, or section	Type of data	Publication and/or reference
Tiskilwa Formation, undivided ***(cont)***			
(Tiskilwa TM)	Northeastern IL	MGS, CM, HM, LM	B94, Willman and Frye 1970
(Tiskilwa TM)	Walworth Co., WI	MGS	GW8, Fricke and Johnson 1983
(Tiskilwa TM)	Southeastern WI	MGS, CM	GW7, Schneider 1983
(Tiskilwa TM, main unit)	Wedron, IL	GS, CM	G16, Johnson et al. 1985a
(Tiskilwa TM)	Lake Michigan basin region	CM	Glass and Killey 1987
(Tiskilwa TM)	Northeastern IL	GS, CM, CC	C543, Wickham et al. 1988
(Tiskilwa TM)	De Kalb, Kane Cos.	GS, E	EGN117, Kempton et al. 1987b
(Tiskilwa T.M)	De Kalb, Kane, Kendall Cos.	GS, E	EGN120, Kempton et al. 1987a
(Tiskilwa TM)	Kane, Kendall Cos.	GS, E	EGN122, Curry et al. 1988
(Tiskilwa TM)	Northeastern IL	GS, E	EGN123, Graese et al. 1988
(Tiskilwa TM, facies D1)	Wedron, IL	GS, CM	R1990B, Johnson and Hansel 1990
(Tiskilwa TM)	Northeastern IL	GS, E	EG139, Bauer et al. 1991
(Tiskilwa M)	Eastern WI	MGS, CM	MP84-1, Mickelson et al. 1984
Tiskilwa Formation, Delavan Member			
(Glenburn TM)	East-central IL	MGS, CM, CC	R1972I, Johnson et al. 1971b
(unit E)	Kane, Du Page Cos.	MGS, CM, E	C456, Landon and Kempton 1971
(Glenburn TM)	East-central IL	MGS, CM, CC	G9, Johnson et al. 1972
(Glenburn TM)	Higginsville Sec.	MGS, CM, CC, HM	G9, Johnson et al. 1972
(Glenburn TM)	Collison Branch Sec.	MGS, CM, CC	G9, Johnson et al. 1972
(Glenburn TM)	Emerald Pond Sec.	MGS, CM, CC, PL	G9, Johnson et al. 1972
(Glenburn TM)	Harmattan Strip Mine Sec.	MGS, CM, CC, HM	G9, Johnson et al. 1972
(Delavan TM)	Northeastern IL	MGS, CM, HM, LM	B94, Willman and Frye 1970
(Shelbyville drift)	Shelbyville, IL	MGS, CM, CC	C459, Johnson et al. 1971a
(unit 4)	McLean Co.	MGS, CM	R1972K, Kempton et al. 1971
(Delavan TM)	Central School Sec.	MGS, CM, CC	G9, Johnson et al. 1972
(Fairgrange till)	West-central IN	MGS, CC, HM, SL	OP11, Bleuer 1975
(Delavan TM)	Farm Creek Sec.	MGS, CM, CC	G13, Follmer et al. 1979
(Delavan TM)	Gardena Sec.	MGS, CM, CC	G13, Follmer et al. 1979
(Delavan TM)	Glendale School Sec.	MGS, CM, CC	G13, Follmer et al. 1979
(Delavan TM)	Graybar Sec.	MGS, CM, CC	G13, Follmer et al. 1979
(Fairgrange TM)	Champaign Co.	GS, CM	C506, Wickham 1979a
(Fairgrange till)	West-central IN	MGS, CC, HM, MS	Bleuer et al. 1982
(Fairgrange till)	West-central IN	MGS, CC, MS	Bleuer et al. 1983
(Tiskilwa TM, lower unit)	Wedron Sec.	GS, CM	G16, Johnson et al. 1985a
(Tiskilwa TM, facies D1)	Wedron, IL	GS, CM	R1990, Johnson and Hansel 1990
Tiskilwa Formation, Delavan Member, Oakland facies			
(unit 5)	McLean Co.	MGS, CM	R1972K, Kempton et al. 1971
(Oakland TM)	East-central IL	MGS, CM, CC	G9, Johnson et al. 1972
(Oakland TM)	Harmattan Strip Mine Sec.	MGS, CM, CC, HM	G9, Johnson et al. 1972
(Oakland TM)	Champaign Co.	GS, CM	C506, Wickham 1979a

Unit (Original name)	Area, county, or section	Type of data	Publication and/or reference
Tiskilwa Formation, Piatt Member			
(Piatt TM)	Champaign Co.	GS, CM	C506, Wickham 1979a
(Tiskilwa TM, facies D2)	Wedron, IL	GS, CM	R1990B, Johnson and Hansel 1990
Lemont Formation , undivided			
(Lemont drift)	Lemont Sec., Worth Sec.	PL	RI185, Horberg and Potter 1955
(Lemont drift)	Lemont Sec.	GS, CM, CC	G16, Johnson and Hansel 1985
(Lemont drift)	Land and Lakes Landfill Sec.	GS, CM	G22, Hansel and Johnson 1986
(Lemont drift)	Northeastern IL	MGS, CM	R1989I, Johnson and Hansel 1989
Lemont Formation, Batestown Member			
(Malden TM, Eureka, Fletchers, and LaMoille drifts)	Northeastern IL	MGS, CM	B94, Willman and Frye 1970
(Batestown TM)	East-central IL	MGS, CM, CC	R1972I, Johnson et al. 1971b
(units 2 and 3)	McLean Co.	MGS, CM	R1972K, Kempton et al. 1971
(units D and C)	Kane, Du Page Cos.	MGS, CM, E	C456, Landon and Kempton 1990
(Batestown TM)	East-central IL	MGS, CM, CC	G9, Johnson et al. 1972
(Batestown TM)	Higginsville Sec.	MGS, CM, CC	G9, Johnson et al. 1972
(Batestown TM)	Collison Branch Sec.	MGS, CM, CC	G9, Johnson et al. 1972
(Batestown TM)	Emerald Pond Sec.	MGS, CM, CC, HM	G9, Johnson et al. 1972
(Batestown TM)	Harmattan Strip Mine Sec.	MGS, CM, CC, HM, PL	G9, Johnson et al. 1972
(Batestown TM)	Champaign Co.	GS, CM	C506, Wickham 1979a
(Malden TM, unit 2)	Wedron Sec.	GS, CM	G16, Johnson et al. 1985a
(Malden TM)	Lake Michigan basin region	CM	Glass and Killey 1987
(Malden TM)	Northeastern IL	GS, CM	C543, Wickham et al. 1988
(Malden TM)	De Kalb, Du Page, Kane, Kendall Cos.	GS, E	EGN117, Kempton et al. 1987b
(Malden TM)	De Kalb, Du Page, Kane, Kendall Cos.	GS, E	EGN120, Kempton et al. 1987a
(Malden TM)	Du Page, Kane, Kendall Cso.	GS, E	EGN122, Curry et al. 1988
(Malden TM)	Northeastern IL	GS, E	EGN123, Graese et al. 1988
(Malden TM, facies D3)	Wedron, IL	GS, CM	R1990B, Johnson and Hansel 1990
(Malden TM)	Northeastern IL	GS, E	EG139, Bauer et al. 1991
Lemont Formation, Yorkville Member			
(Marseilles till, Huntley till)	McHenry Co.	GS, CM, E	EGN19, Smith 1968
(Yorkville TM)	Northeastern IL	MGS, CM, HM, LM	B94, Willman and Frye 1970
(Snider TM)	East-central IL	MGS, CM, CC	R1972I, Johnson et al. 1971b
(unit 1)	McLean Co.	MGS, CM	R1972K, Kempton et al. 1971
(unit B)	Kane, Du Page Cos.	MGS, CM, E	C456, Landon and Kempton 1971
(Snider TM)	East-central IL	MGS, CM, CC	G9, Johnson et al. 1972
(Snider TM)	Higginsville Sec.	MGS, CM, CC	G9, Johnson et al. 1972
(Snider TM)	Collison Branch Sec.	MGS, CM, CC	G9, Johnson et al. 1972
(Snider TM)	Emerald Pond Sec.	MGS, CM, CC, HM	G9, Johnson et al. 1972

Unit (Original name)	Area, county, or section	Type of data	Publication and/or reference
Lemont Formation, Yorkville Member ***(cont)***			
(Snider TM)	Harmattan Strip Mine Sec.	PL	G9, Johnson et al. 1972
(Yorkville TM)	Grundy, Kendall, La Salle, Livingston Cos.	GS, CM, CC	C526, Killey 1982
(Yorkville TM)	Northeastern IL	MGS, CM, CC, E	Kemmis 1981
(Snider till)	West-central IN	MGS, CC, MS	Bleuer et al. 1983
(Malden TM, unit 3)	Wedron Sec.	GS, CM	G16, Johnson et al. 1985a
(Yorkville TM)	Beverly Sec.	GS, CM	G16, Hansel et al. 1985a
(Yorkville TM)	Du Page, Kendall Cos.	GS, E	EGN117, Kempton et al. 1987b
(Yorkville TM)	Du Page Co.	GS, E	EGN120, Kempton et al. 1987a
(Yorkville TM)	Lake Michigan basin region	CM	Glass and Killey 1987
(Yorkville TM)	Northeastern IL	GS, CM	C543, Wickham et al. 1988
(Yorkville TM)	Du Page, Kendall Cos.	GS, E	EGN122, Curry et al. 1988
(Yorkville TM)	Northeastern IL	GS, E	EGN123, Graese et al. 1988
(Malden TM, facies D4)	Wedron, IL	GS, CM	R1990B, Johnson and Hansel 1990
(Yorkville TM)	Northeastern IL	GS, E	EG139, Bauer et al. 1991
Lemont Formation, Haeger Member and Haeger-equivalent New Berlin Member, Holy Hill Formation			
(West Chicago till)	McHenry Co.	GS, CM, E	EGN19, Smith 1968
(Haeger TM)	Northeastern IL	MGS, CM, HM, LM	B94, Willman and Frye 1970
(group 1 tills)	Eastern WI	MGS, CM, E	Mickelson et al. 1979
(New Berlin F)	Eastern WI	MGS, CM	MP84-1, Mickelson et al. 1984
(Haeger TM)	Beverly Sec.	GS, CM	G16, Hansel et al. 1985a
(Haeger TM)	Northeastern IL	GS, CM	C543, Wickham et al. 1988
(New Berlin till)	Southeastern WI	MGS, CM	GW7, Schneider 1983
(Haeger TM)	Du Page Co.	GS, E	EGN117, Kempton et al. 1987b
(Haeger TM)	Northeastern IL	GS, E	EGN123, Graese et al. 1988
(Haeger TM)	Northeastern IL	MGS, CM	R1989I, Johnson and Hansel 1989
(Haeger TM)	Northeastern IL	GS, E	EG139, Bauer et al. 1991
Wadsworth Formation and Wadsworth-equivalent Oak Creek Formation			
(Wadsworth TM)	Northeastern IL	MGS, CM, HM, LM	B94, Willman and Frye 1970
(Wadsworth TM)	Lake Michigan, Lake Border Moraines	CM	EGN69, Lineback et al. 1974
(Wadsworth TM)	Lake Michigan	GS, CM	EGN84, Wickham et al. 1978
(group 2 tills)	Eastern WI	MGS, CM, E	Mickelson et al. 1979
(Wadsworth TM)	Northeastern IL, southeastern WI	MGS, CM	GW7, Hansel 1983
(Oak Creek F)	Southeastern WI	MGS, CM	GW7, Schneider 1983
(Oak Creek F)	Eastern WI	MGS, CM	MP84-1, Mickelson et al. 1984
(Wadsworth TM)	Lemont Sec.	GS, CM, CC	G16, Johnson and Hansel 1985
(Wadsworth TM)	Land and Lakes Landfill Sec.	GS, CM	G22, Hansel and Johnson 1986
(Wadsworth TM)	Du Page Co.	GS, E	EGN117, Kempton et al. 1987b
(Wadsworth TM)	Lake Michigan basin region	CM	Glass and Killey 1987
(Wadsworth TM)	Northeastern IL	GS, E	EGN123, Graese et al. 1988
(Wadsworth TM)	Northeastern IL	MGS, CM	R1989I, Johnson and Hansel 1989
(Wadsworth TM)	Northeastern IL	GS, E	EG139, Bauer et al. 1991

Unit (Original name)	Area, county, or section	Type of data	Publication and/or reference
Kewaunee Formation			
(Shorewood TM, Manitowoc TM, Two Rivers TM)	Lake Michigan, Lake Michigan bluffs	CM	EGN69, Lineback et al. 1974
(Shorewood TM, Manitowoc TM, Two Rivers TM)	Lake Michigan, Lake Michigan bluffs	CM	EGN84, Wickham et al. 1978
(group 3 tills)	Lake Michigan bluffs	MGS, CM, E	Mickelson et al. 1979
(Ozaukee, Haven, Valders, Two Rivers tills)	Eastern WI	MGS, CM, CC, MS	Acomb et al. 1982
(Ozaukee, Haven, Valders, Two Rivers M)	Eastern WI	MGS, CM	MP84-1, Mickelson et al. 1984
(Valders M)	Brown Co., WI	MGS, CC, MS	IC48, Need 1985
(Shorewood TM, Manitowoc TM, Two Rivers TM)	Lake Michigan basin region	CM	Glass and Killey 1987

Other analytical data for cores in northern Illinois are published in EGNs 2, 6, 7, 10, 53, 71, 75, and 77, but lithostratigraphic units are not identified.

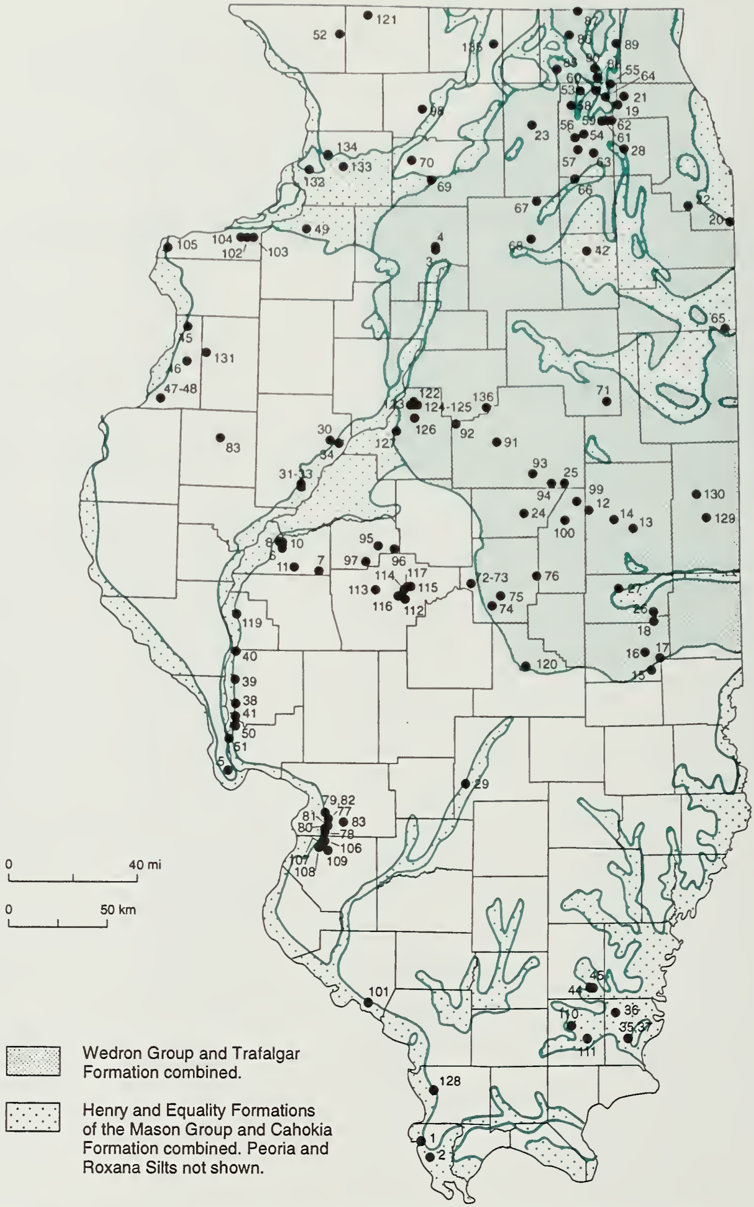

Figure 33 Distribution of sites with radiocarbon ages in Illinois. Numbers correspond to sites listed by county in appendix B1. Boundaries for the Wedron Group and the Mason Group Henry and Equality Formations are modified from Lineback (1979). County names shown on plate 1.

APPENDIX B1
Location of Stratigraphically Significant Radiocarbon Ages in Illinois and Lake Michigan
(site located by number on figure 33)

Location no., site, Sec/Twp/Rge	Lab no.	Age	Lithostratigraphic unit	Reference
Alexander County				
(1) Gale, Center Sec. 33, T14S R3W				
	W-869	37,000±1,500	Roxana S	Rubin and Alexander 1960
(2) Olive Branch, SE NW NW, Sec. 25, T15S R3W				
	ISGS-2507	20,230±510	Peoria S	Unpublished
Bureau County				
(3) East Bureau Creek, SE NW, Sec. 8, T16N R10E				
	W-333	25,700±800	Robein M	Rubin and Alexander 1958
	W-334	22,450±1,000	Peoria S	Rubin and Alexander 1958
	W-642	26,200±800	Robein M	Rubin and Alexander 1960
(4) Malden South II, SW SE SE, Sec. 5, T16N R10E				
	ISGS-614	27,300±540	Robein M	Liu and Coleman 1981
Calhoun County				
(5) Metz Creek, SE SW SW, Sec. 1, T13S R2W				
	ISGS-1531	13,710±270	Equality F	Hajic 1990
Cass County				
(6) Cass A, NE SE NE, Sec. 24, T18N R11W				
	ISGS-122	24,980±420	Robein M	Coleman 1974
(7) Cass B, NW NW SW, Sec. 25, T17N R9W				
	ISGS-123	21,080±370	Robein M	Coleman 1974
(8) Cottonwood School, center E line, Sec.11, T18N R11W				
	ISGS-195	12,740±210	Peoria S	Frye et al. 1974
	ISGS-1363	19,400±300	Peoria S	Unpublished
	ISGS-1364	17,600±320	Peoria S	Unpublished
(9) Cottonwood School South, NW NW SW, Sec. 12, T18N R11W				
	ISGS-137	15,640±580	Peoria S	Coleman 1974, Frye et al. 1974
	ISGS-138	10,410±650	Peoria S	Coleman 1974, Frye et al. 1974
(10) Jules, SE SE NE, Sec. 13, T18N R11W				
	ISGS-179	15,020±300	Peoria S	Frye et al. 1974
(11) Virginia, NE NE, Sec. 22, T17N R10W				
	W-526	29,000±1,200	Robein M	Rubin and Alexander 1960
Champaign County				
(12) Mahomet SW, SW SE NW, Sec. 20, T20N R7E				
	ISGS-79	21,670±130	Robein M	Coleman 1973
(13) Sunnycrest Drainage Ditch, NE NW NE Sec. 22, T19N R9E				
	ISGS-767	17,690±270	Peoria S	Liu et al 1986, Hansel and Johnson 1992
(14) Parkland College, SE NW SW, Sec. 3, T19N R8E				
	ISGS-69	13,980±200	Equality F	Coleman 1973
Coles County				
(15) Center School, NW NW SW, Sec. 15, T11N R10 E				
	ISGS-89	20,500±130	Robein M	Johnson et al. 1972, Coleman 1973
	ISGS-2921	20,030±150	Robein M	Unpublished
	ISGS-2922	20,090±150	Robein M	Unpublished
	ISGS-2923	20,440±160	Robein M	Unpublished

Location no., site, Sec/Twp/Rge	Lab no.	Age	Lithostratigraphic unit	Reference
(15) Center School, NW NW SW, Sec. 15, T11N R10 E *(cont)*				
	ISGS-2924	21,950±180	Robein M	Unpublished
	ISGS-3099	21,680±520	Robein M	Unpublished
(16a) Charleston Quarry, SW NE NW, Sec. 5, T12N R10E				
	ISGS-28	21,300±500	Robein M	Kim 1970
(16b) Charleston Quarry, SW SW NW, Sec. 5, T12 N R10E				
	ISGS-2593	20,050±170	Robein M	Unpublished
	ISGS-2842	19,980±150	Robein M	Unpublished
	ISGS-2918	19,340±180	Robein M	Unpublished
	ISGS-2919	20,660±170	Robein M	Unpublished
(16c) Charleston Quarry, NW NE SW, Sec. 5, T12N R10E				
	ISGS-27	19,500±200	Ashmore T	Kim 1970
(17) ISGS Test Site DAA-19, SE, Sec. 18, T12N R11 E				
	ISGS-681	32,620±650	Robein M	Liu et al. 1986
	ISGS-686	25,170±150	Robein M	Liu et al. 1986
(18) Oakland 70F17, SW NE, Sec. 14, T14N R10E				
	ISGS-93	26,900±1,100	Robein M	Coleman 1973
	ISGS-94	24,600±1,300	Tiskilwa F, Oakland facies	Coleman 1973
Cook County				
(19) Elgin Bog, SW SE SW, Sec. 8, T41N R9E				
	ISGS-1550	14,330±250	Henry F	Hansel and Johnson 1992
(20) Lynwood Reservoir, NW NE SE, Sec. 19, T35N R15E				
	ISGS-1549	13,870±170	Henry F, Dolton facies	Hansel and Johnson 1992
	ISGS-1570	14,100±640	Henry F, Dolton facies	Hansel and Johnson 1992
(21) NIPC-19, SE NE NE, Sec. 28, T42N R9E				
	I-2783	23,000±2,000	Robein M	Kempton and Hackett 1968b
(22) Tinley Park, SE NE NW, Sec. 25, T36N R12E				
	ISGS-1649	13,890±120	Henry F, Dolton facies	Hansel and Johnson 1992
De Kalb County				
(23) New De Kalb Water Tower, SW NE SW, Sec. 10, T40N R4E				
	ISGS-2111	14,050±150	Equality F	Unpublished
De Witt County				
(24) Clinton Power Plant, NE NW NW, Sec. 26, T20N R3E				
	ISGS-828	20,670±280	Morton T	Liu et al. 1986
(25) Farmer City, NW SE NW, Sec. 21, T21N R5E				
	I-2517	21,950±500	Robein M	Kempton et al. 1971
Douglas County				
(26) Observatory Boring 3, NE NE SW, Sec. 35, T15N R10E				
	I-2519	20,000±400	Robein M	Kempton and Gross 1971
(27) Tuscola Borrow Pit, NE SE SW, Sec. 26, T16N R8E				
	ISGS-37	30,700±500	Robein M	Coleman 1972
Du Page County				
(28) Du Page Mammoth Site, NW NW SE, Sec. 22, T39N R9E				
	ISGS-465	15,240±120	Equality F	Liu et al. 1986, Hansel and Johnson 1992
	ISGS-485	13,130±350	Equality F	Liu et al. 1986

Location no., site, Sec/Twp/Rge	Lab no.	Age	Lithostratigraphic unit	Reference
Fayette County				
(29a) Pittsburg Basin, SW NE SW, Sec. 3, T5N R1W				
	ISGS-47	21,370±810	Equality F	Coleman 1972, Grüger 1972a
	ISGS-53	24,200±1,900	Equality F	Coleman 1972, Grüger 1972a
	ISGS-65	24,200±800	Equality F	Grüger 1972a, Coleman 1973
	ISGS-67	34,000±1,200	Equality F	Grüger 1972a, Coleman 1973
	ISGS-71	37,200±900	Equality F	Grüger 1972a, Coleman 1973
(29b) Pittsburg Basin, SE NW SW, Sec. 3, T5N R1W				
	ISGS-738	32,590±930	Equality F	Liu et al. 1986
	ISGS-748	39,800±1,200	Equality F	Liu et al. 1986
	ISGS-750	40,030±990	Equality F	Liu et al. 1986
	ISGS-742	41,110±810	Equality F	Liu et al. 1986
Fulton County				
(30) Buckheart Strip Mine, SE, Sec. 13, T6N R4E				
	W-849	23,700±550	Robein M	Rubin and Alexander 1960
	W-853	25,500±600	Robein M	Rubin and Alexander 1960
(31) Enion, SE SE NW, Sec. 33, T4N R3E				
	W-745	23,500±400	Robein M	Rubin and Alexander 1960
(32) Enion North, NE NE SW, Sec. 28, T4N R3E				
	W-870	20,300±400	Peoria S	Rubin and Alexander 1960
(33) Kearney Cemetary, NW SE NE, Sec. 33, T4N R3E				
	ISGS-1721	20,400±190	Equality F	Hajic 1990
(34) Rice Lake, NE NE SW, Sec. 21, T6N R5E				
	ISGS-1379	15,000±240	Equality F	Unpublished
Gallatin County				
(35) Big Cypress Ditch, NE NW SW, Sec. 20, T9S R9E				
	ISGS-101	12,780±100	Equality F	Coleman 1973
	ISGS-103	13,030±190	Equality F	Coleman 1973
(36) Edwards Farm, NE NW NE, Sec. 10, T8S R8E				
	ISGS-546	21,460±210	Equality F	Liu and Coleman 1981
(37) Little Cypress Ditch, NW NW NW, Sec. 20, T9S R9E				
	ISGS-88	17,510±330	Equality F	Coleman 1973
	ISGS-95	23,500±960	Equality F	Coleman 1973
	ISGS-96	19,160±690	Equality F	Coleman 1973
Greene County				
(38) GR-1, NE NE NW, Sec. 33, T10N R13W				
	AA-7318	>37,000	Roxana S	Leigh and Knox 1993
(39) Hartwell Levee District, SE SW NW, Sec. 21, T11N R13 W				
	ISGS-900	13,010±140	Equality F	Liu et al. 1986
(40) Hillview Levee District, NW NE NE, Sec. 4, T12N R13W				
	ISGS-1122	9,300±150	Equality F	Hajic 1990
(41a) Koster, SW NW SW, Sec. 21, T9N R13W				
	ISGS-415	12,325±75	Equality F	Liu et al. 1986
(41b) Koster, SE NE SW, Sec. 21, T9N R13W				
	ISGS-875	13,360±100	Equality F	Wiant et al. 1983
Grundy County				
(42) Morris North, SE NE NE, Sec. 33, T34N R7E				
	ISGS-61	24,990±280	Peddicord T	Willman et al. 1971, Coleman 1973
Hamilton County				
(43) Mitchell Farm, SE SE SW, Sec. 33, T6S R7E				
	ISGS-547	20,510±170	Equality F	Liu and Coleman 1981
(44) Zipp Profile no. 23, SE NE SE, Sec. 32, T6S, R7E				
	ISGS-560	20,830±160	Equality F	Liu and Coleman 1981

Location no., site, Sec/Twp/Rge	Lab no.	Age	Lithostratigraphic unit	Reference
Henderson County				
(45) Bald Bluff, NE NE SE, Sec. 20, T12N R4W				
	I-1720	13,700±260	Peoria S	Frye et al. 1968
(46) Biggsville Quarry, SW, Sec. 17, T10N R4W				
	ISGS-1231	21,410±290	Robein S	Baker et al. 1989
	ISGS-1522	23,230±710	Robein S	Unpublished
	Beta-4129	27,870±420	Robein S	Baker et al. 1989
(47a) Lomax, NW NW NW, Sec. 13, T8N R6W				
	ISGS-136	20,320±120	Peoria S	Coleman 1974
	ISGS-261	21,250±220	Robein M	Liu and Coleman 1981
(47b) Lomax, SE SW SW, Sec. 12, T8N R6W				
	ISGS-1635	26,840±470	Robein M	Curry and Follmer 1992
	ISGS-1637	28,900±1,500	Robein M	Curry and Follmer 1992
	ISGS-1720	24,720±320	Robein M	Curry and Follmer 1992
	ISGS-1730	21,250±250	Robein M	Curry and Follmer 1992
	ISGS-1832	17,240±190	Henry F, Parkland facies	Curry and Follmer 1992
	ISGS-2110	20,410±210	Robein M	Unpublished
(48) P-7681A, NW NW NW, Sec. 13, T8N R6W				
	ISGS-136	20,320±120	Robein M	Coleman 1974
Henry County				
(49) Geneseo Landfill Core, SE SE NW, Sec. 9, T17N R3E				
	ISGS-426	13,300±240	Henry F	Liu and Coleman 1981
Jersey County				
(50) Nutwood Levee District, NW SW SW, Sec. 4, T8N R13W				
	ISGS-894	13,390±190	Equality F	Liu et al. 1986
(51) Nutwood Levee District, SW SW SW, Sec. 30, T8N R13W				
	ISGS-1135	9480±130	Equality F	Hajic 1990
Jo Daviess County				
(52) Stockton NE Core 2, NE NW NE, Sec. 32, T28N R5E				
	ISGS-24	27,200±400	Robein M	Kim 1970
	ISGS-30	26,300±400	Robien M	Kim 1970
Kane County				
(53) B-13, SE NE SW, Sec. 18, T42N R7E				
	I-1625	26,900±1,500	Robein M	Kempton and Hackett 1968a
(54) Biddle Farm, NW, Sec. 28, T40N R7E				
	ISGS-2079	13,530±100	Equality F	Unpublished
	ISGS-2981	13,590±230	Equality F	Unpublished
	ISGS-2083	12,380±140	Equality F	Unpublished
(55) Carpentersville Pit, NW NE SW, Sec. 2, T42N R8E				
	ISGS-238	37,600±1,300	Robein M	Coleman and Liu 1975 Wickham et al. 1988
(56) Elburn Forest Preserve S-30, NE NE NE, Sec. 36, T40N R6E				
	ISGS-1593	26,610±390	Robein M	Curry 1989
	ISGS-1594	41,000±3,100	Robein M	Curry 1989
(57) Feltes Pit, SW NW SE, Sec. 19, T39N R7E				
	ISGS-2108	23,710±320	Tiskilwa F, Oakland facies	Unpublished
(58) Fermi-4, SW SW NE, Sec. 11, T41N R6E				
	ISGS-1295	36,600±3,200	Robien M	Curry 1989
	ISGS-1296	27,250±340	Robein M	Curry 1989
(59) Fox River Stone Company, NE NE SE, Sec. 4, T40N R8E				
	ISGS-1872	29,500±1,000	Tiskilwa F	Unpublished

Location no., site, Sec/Twp/Rge	Lab no.	Age	Lithostratigraphic unit	Reference
Kane County *(cont)*				
(60) Test Boring 13-42-7, NE NE NE, Sec. 13, T42N R7E				
	ISGS-127	25,230±570	Robein M	Coleman 1974 Hansel and Johnson 1992
(61) Van Acker Gravel Pit, NE SW SE, Sec. 3, T40N R8E				
	ISGS-1339	37,100±2,000	Robein M	Unpublished
(62) Woodland Landfill, NE SE NW, Sec. 1, T40N R8E				
	ISGS-1113	26,890±400	Robein M	Wickham et al. 1988
(63) Nelson Lake Core, SE SW NE, Sec. 25, T39N R7E				
	AA-4680*	14,780±150	Equality F	Unpublished
(64) Sleepy Hollow Core, SW NW NW, Sec. 28 T42N R8E				
	ISGS-2049	33,500±690	Robein M	Unpublished
	ISGS-2054	13,670±140	Henry F	Unpublished
Kankakee County				
(65) SE Kankakee Co. Dune Field, NE NW NE, Sec. 10, T29N R11W				
	ISGS-271	12,990±120	Henry F, Parkland facies	Liu and Coleman 1981
Kendall County				
(66) Big Rock Creek, SW SE NE, Sec. 1, T37N R6E				
	ISGS-557	40,580±1,100	Robein M	Liu and Coleman 1981
	ISGS-559	40,400±1,400	Robein M	Liu and Coleman 1981
La Salle County				
(67) NIU-28 Series, NW SE NW, Sec. 11, T36N R4E				
	ISGS-482	12,410±130	Equality F	Liu et al. 1986
	ISGS-483	11,080±350	Equality F	Liu et al. 1986
	ISGS-498a	10,890±210	Equality F	Liu et al. 1986
	ISGS-489b	10,990±110	Equality F	Liu et al. 1986
(68a) Wedron Quarry, SE SE SW, Sec. 9, T34N R4E				
	W-79	24,000±700	Peddicord T	Suess 1954
	W-871	26,800±700	Peddicord T	Rubin and Alexander 1960
(68b) Wedron Quarry, NW SE NW, Sec. 9, T34N R4E				
	ISGS-31	25,900±500	Tiskilwa F	Kim 1970
(68c) Wedron Quarry, SW NW SW, Sec. 9, T34N R4E				
	ISGS-862	24,900±200	Robein M	Liu et al. 1986 Willman and Frye 1970
(68d) Wedron Quarry, SW NW SW, Sec. 9, T34N R4E				
	ISGS-863	24,370±310	Peddicord T	Liu et al. 1986 Hansel and Johnson 1992
(68e) Wedron Quarry, SE NW NW, Sec. 16, T34N R4E				
	ISGS-1486	21,460±470	Ashmore T	Garry et al. 1990 Hansel and Johnson 1992
(68f) Wedron Quarry, NW SW SW, Sec. 16, T34N R4E				
	ISGS-2484	21,370±240	Ashmore T	Unpublished
Lee County				
(69) Amboy West, SW SW NW, Sec. 19, T20N R10E				
	ISGS-624	37,290±790	Robein M	Liu and Coleman 1981
(70) E-W Tollway Boring 64, SW SE NW, Sec. 19, T21N R9E				
	ISGS-125	22,190±960	Robein M	Coleman 1974
Livingston County				
(71) Chatsworth (Strawn) Bog, SW SW SE, Sec. 32, T26N R8E				
	ISGS-527	14,380±150	Equality F	Liu and Coleman 1981 King 1986

*Radiocarbon age determined by accelerator mass spectrometry

Location no., site, Sec/Twp/Rge	Lab no.	Age	Lithostratigraphic unit	Reference
Macon County				
(72) Ni 323-335, NE SW NW, Sec. 13, T16N R1W				
	ISGS-25	>33,000	Roxana S	Kim 1970
(73) P-3866, NE SW NW, Sec. 13, T16N R1W Grüger 1972b				
	ISGS-21	25,500±600	Robein M	Kim 1970, Grüger 1972b
(74) TA-3, S-7, SE, Sec. 19, T15N R2E				
	ISGS-723	20,870±130	Robein M	Liu et al. 1986
(75) TA-6, S-9, SW SW NE, Sec. 3, T15N R2E				
	ISGS-727	21,250±170	Robein M	Liu et al. 1986
(76) RMM-1, SW NW NW, Sec. 4, T16N R4E				
	ISGS-80	13,090±110	Henry F	Coleman 1973
Madison County				
(77) Burdick Branch, NW SW, Sec. 4, T3N R8W				
	W-730	17,100±300	Peoria S	Rubin and Alexander 1960
(78) Collinsville, SE NW NE, Sec. 29, T3N R8W				
	W-1055	17,950±550	Peoria S	Ives et al. 1964
(79) Edwardsville, NW NE SE, Sec. 29, T4N R8W				
	ISGS-39	20,000±500	Robein M	Kim 1970
	ISGS-45	21,350±320	Robein M	Kim 1970
(80) Pleasant Grove School, Center SE, Sec. 20, T3N R8W				
	W-729	35,200±1,000	Roxana S	Rubin and Alexander 1960
(81) Sugarloaf Road Core G-39, NW NE NW, Sec. 16, T3N R8W				
	ISGS-412	20,910±520	Peoria S	Liu and Coleman 1981
	ISGS-413	23,110±800	Peoria S	Liu and Coleman 1981
(82) Sunset Hills, NW NE SE, Sec. 29, T4N R8W				
	ISGS-128	19,900±1,300	Henry F	Coleman 1974
	ISGS-129	19,750±500	Henry F	Coleman 1974
(83) Troy Auger 12.0, NE NW SE, Sec. 8, T3N R7W				
	ISGS-575	26,050±330	Robein M	Liu and Coleman 1981
McDonough County				
(84) McKee Farm, NW NW NW, Sec. 18, T6N R2W				
	ISGS-975	37,700±1400	Robein M	Liu et al. 1986
	ISGS-1041	25,269±280	Robein M	Liu et al. 1986
	ISGS-1042	37,800±2,100	Robein M	Liu et al. 1986
	ISGS-1133	34,920±590	Robein M	Unpublished
McHenry County				
(85) B-3, NW SE SE, Sec. 12, T43N R5E				
	I-847	38,000±3000	Robein M	Kempton and Hackett 1968a
(86) B-8, NW SW NW, Sec. 15, T45N R6E				
	I-849	25,600±800	Robein M	Kempton and Hackett 1968a Hansel and Johnson 1992
(87) Hebron Core MC-8, NE NE NE, Sec. 6, T46N R7E				
	ISGS-2601	24,780±360	Morton T	Curry and Pavich 1994
	ISGS-2602	26,030±450	Robein M	Curry and Pavich 1994
(88) NIPC-5, NE NE SE, Sec. 30, T43N R8E				
	I-1624	25,300±1,100	Robein M	Kempton and Hackett 1968a
(89) Possum Run Pit, NE NE SE, Sec. 31, T45N R9E				
	ISGS-1412	41,800±2,000	Robein M	Unpublished
(90) Wedgewood, SW NE NW, Sec. 12, T43N R7E				
	ISGS-3021	23,230±550	Equality F	Unpublished

Location no., site, Sec/Twp/Rge	Lab no.	Age	Lithostratigraphic unit	Reference
McLean County				
(91) Browkaw Hospital Boring 4, SW SW NE, Sec. 33, T24N R2E				
	I-2518	22,450±500	Tiskilwa F	Kempton et al. 1971
(92) Danvers (Rock Creek), NE NW, Sec. 32, T25N R1W				
	W-406	26,150±700	Robein M	Rubin and Alexander 1958
	W-483	20,500±600	Morton T	Rubin and Alexander 1958
	ISGS-12	23,900±200	Robein M	Kim 1970
	ISGS-3100	19,830±190	Morton T	Unpublished
(93) LeRoy Boring 4, NE NE SE, Sec. 20, T22N R4E				
	I-2220	27,200±950	Robein M	Kempton et al. 1971
(94) Test Hole ISGS-3-67, SW SE SW, Sec. 5, T21N R5E				
	I-2785	24,600±750	Robein M	Kempton and Gross 1971
Menard County				
(95a) Athens North Quarry, SW SW NE, Sec. 18, T18N R5W				
	ISGS-534	22,170±450	Peoria S	Follmer et al. 1979 Liu and Coleman 1981 Curry and Follmer 1992
	ISGS-536	25,170±200	Robein M	Follmer et al. 1979 Liu and Coleman 1981
(95b) Athens North Quarry, NE SW NE, Sec. 18, T18N R5W				
	ISGS-654	38,920±1,100	Robein M	Liu and Coleman 1981, Follmer 1983 Curry and Follmer 1992
	ISGS-870	35,750±620	Robein M	Liu et al. 1986 Curry and Follmer 1992
	ISGS-883	37,100±1,200	Robein M	Curry and Follmer 1992
(95c) Athens North Quarry, NE NE NW, Sec. 18, T18N R5W				
	ISGS-1859	43,800±3,000	Robein M	Curry and Follmer 1992
	ISGS-1860	32,800±3,200	Robein M	Curry and Follmer 1992
	ISGS-1861	21,190±460	Robein M	Curry and Follmer 1992
	ISGS-1873	29,220±630	Robein M	Curry and Follmer 1992
	ISGS-1878	27,770±450	Robein M	Curry and Follmer 1992
	ISGS-1879	28,090±470	Robein M	Curry and Follmer 1992
	ISGS-1880	28,240±460	Robein M	Curry and Follmer 1992
	ISGS-1883	28,440±310	Robein M	Curry and Follmer 1992
	ISGS-1888	29,620±630	Robein M	Curry and Follmer 1992
	ISGS-1889	34,230±710	Robein M	Curry and Follmer 1992
	ISGS-1897	27,330±290	Robein M	Curry and Follmer 1992
	ISGS-1904	36,800±1200	Robein M	Curry and Follmer 1992
	ISGS-1905	31,110±450	Robein M	Curry and Follmer 1992
	ISGS-1910	36,930±770	Robein M	Curry and Follmer 1992
	ISGS-2981	20,880±370	Peoria S	Unpublished
	ISGS-3027	22,120±230	Peoria S	Unpublished
	ISGS-3028	23,560±300	Peoria S	Unpublished
	ISGS-3029	25,110±280	Peoria S	Unpublished
(96) Fancy Prairie, SW SE SW, Sec. 24, T18N R5W				
	ISGS-90	24,450±280	Robein M	Coleman 1973
(97) Sangamon River Valley Boring 7, NE NE NW, Sec. 9, T17N R6W				
	ISGS-110	20,740±720	Robein M	Miller 1973, Coleman 1974
Ogle County				
(98) Mt. Morris Core, SE SE SE, Sec. 34, T24N R9E				
	ISGS-374	35,600±1,000	Robein M	Liu and Coleman 1981

Location no., site, Sec/Twp/Rge	Lab no.	Age	Lithostratigraphic unit	Reference
Piatt County				
(99) Mansfield Borrow Pit, NE SW NW Sec. 3, T20N R6E				
	ISGS-1123	21,360±720	Robein M	Unpublished
(100) Monticello Borrow Pit, SE NW NE Sec. 1, T19N R5E				
	ISGS-408	28,970±290	Robein M	Liu and Coleman 1981
	ISGS-422	22,850±290	Robein M	Liu and Coleman 1981
	ISGS-423	37,950±700	Robein M	Liu and Coleman 1981
	ISGS-490	34,290±840	Robein M	Curry 1989
Randolph County				
(101) Clores Bridge, NW NW NW Sec. 27, T7S R6W				
	ISGS-331	15,330±170	Henry F	Liu and Coleman 1981
Rock Island County				
(102) Airport West, SW SW NE Sec. 29, T17N R1W				
	ISGS-375	41,200±1600	Robein M	Liu and Coleman 1981
	ISGS-476	26,180±800	Robein M	Liu and Coleman 1981
(103) Coal Creek, NE NE NW, Sec. 27, T17N R1W				
	ISGS-1303	21,470±590	Peoria S	Unpublished
(104) Collinson Quarry, NE SE NW, Sec. 25, T17N R2W				
	ISGS-1365	18,420±360	Peoria S	Unpublished
(105) Reynolds School, NW SE SE, Sec. 18, T16N R5W				
	ISGS-78	16,160±140	Henry F	Coleman 1973
St. Clair County				
(106) Bunkum Borrow Pit, NW SW SW, Sec. 18, T2N R8W				
	ISGS-400	30,980±400	Roxana S	Liu and Coleman 1981
(107) Canteen Creek, SW NE NW, Sec. 8, T2N R8W				
	ISGS-392	36,100±550	Roxana S	McKay 1979a, Liu and Coleman 1981
	ISGS-393	40,200±1,500	Roxana S	McKay 1979a, Liu and Coleman 1981
	ISGS-421	16,020±260	Peoria S	Liu and Coleman 1981
(108) French Village, SE SW SW, Sec. 24, T2N R9W				
	ISGS-157	35,750±760	Roxana S	Coleman 1974
(109) Ruby Lane, NW NE NW, Sec. 28, T2N R8W				
	ISGS-294	21,910±270	Peoria S	Liu and Coleman 1981
	ISGS-307	23,930±280	Peoria S	Liu and Coleman 1981
Saline County				
(110) Barnes Farm, NE NW SE, Sec. 32, T8S R6E				
	ISGS-549	21,780±410	Equality F	Liu and Coleman 1981
(111) Big Ridge, SE NW NW, Sec. 19, T9S R7E				
	ISGS-84	20,600±220	Equality F	Coleman 1973
	ISGS-87	20,900±140	Equality F	Coleman 1973
Sangamon County				
(112) C-502, NE NW NW, Sec. 6, T15N R4W				
	ISGS-673	33,000±1,000	Henry F	Liu et al. 1986
(113) Sangamon River Valley Boring 4, SW NE NE, Sec. 25, T16N R6W				
	ISGS-109	17,650±450	Equality F	Miller 1973, Coleman 1974
(114) Sangamon River Valley Boring 8, NW NE SW, Sec. 28, T16N R4W				
	ISGS-118	29,140±270	Henry F	Miller 1973, Coleman 1974
(115) Sangamon River Valley Boring 9, NW SW NE, Sec. 22, T16N R4W				
	ISGS-102	24,640±430	Robein M	Coleman 1973, Miller 1973
(116) Sangamon River Valley Boring 10, NW, Sec. 9, T15N R4W				
	ISGS-108	22,150±330	Robein M	Miller 1973, Coleman 1974

Location no., site, Sec/Twp/Rge	Lab no.	Age	Lithostratigraphic unit	Reference
Sangamon County *(cont)*				
(117) Sangamon River Valley No. 36, NW NW NW, Sec. 23, T16N R4W				
	ISGS-107	22,020±300	Robein M	Miller 1973, Coleman 1974
(118) Sugar Creek Valley Boring 8, NW NE SW, Sec. 28, T16N R4W				
	ISGS-99	22,700±110	Robein M	Coleman 1973, Miller 1973
Scott County				
(119) Smiling Dan, NW SW SW, Sec. 4, T14N R13W				
	ISGS-851	23,380±500	Equality F	Hajic 1985
Shelby County				
(120) Shelby County Moraine, NE SE SW, Sec. 8, T11N R3E				
	ISGS-26	20,000±200	Robein M	Kim 1970, Johnson et al. 1971a
	ISGS-32	21,300±500	Robein M	Kim 1970, Johnson et al. 1971a
	ISGS-46	21,400±1,000	Robein M	Coleman 1972, Johnson et al. 1971a
Stephenson County				
(121) Stubbe Farm, SW NE NE, Sec. 35, T29N R6E				
	ISGS-561	26,820±200	Henry F	Liu and Coleman 1981 Whittecar and Davis 1982
	ISGS-479	31,400±740	Henry F	Liu and Coleman 1981 Whittecar and Davis 1982
	ISGS-562	40,500±1,700	Henry F	Liu and Coleman 1981 Whittecar and Davis 1982
Tazewell County				
(122) Farm Creek, NE SW SE, Sec. 30, T26N R3W				
	W-68	22,900±900	Robein M	Suess 1954
	W-69	25,100±800	Robein M	Suess 1954
	W-349	20,340±750	Morton T	Rubin and Alexander 1958 Follmer et al. 1979
	W-399	20,700±650	Morton T	Rubin and Alexander 1958 Follmer et al. 1979
	ISGS-533	26,680±380	Robein M	Follmer et al. 1979 Liu and Coleman 1981
	ISGS-535	27,700±770	Robein M	Follmer et al. 1979 Liu and Coleman 1981
	ISGS-2438	20,840±250	Peoria S	Unpublished
	ISGS-2485	20,550±280	Peoria S	Unpublished
(123) Farmdale Dam, SE SE, Sec. 36, T26N R4W				
	W-187	19,200±700	Delavan M	Rubin and Suess 1955
(124) Farmdale Railroad Cut, NW, Sec. 31, T26N R3W				
	W-524	18,460±500	Delavan M	Rubin and Alexander 1960
(125) Gardena, NW SW NW, Sec. 32, T26N R3W				
	ISGS-529	25,690±280	Robein M	Follmer et al. 1979 Liu and Coleman 1981
	ISGS-530	25,680±1,000	Morton T	Follmer et al. 1979 Liu and Coleman 1981
	ISGS-531	25,370±310	Morton T	Follmer et al. 1979 Liu and Coleman 1981
	ISGS-532	19,680±460	Morton T	Follmer et al. 1979 Liu and Coleman 1981 Hansel and Johnson 1992
(126) Getz Borrow Pit, SW NE SE, Sec. 19, T25N R3W				
	ISGS-2047	20,020±230	Morton T	Unpublished
	ISGS-2048	20,720±490	Morton T	Unpublished

Location no., site, Sec/Twp/Rge	Lab no.	Age	Lithostratigraphic unit	Reference
Tazewell County ***(cont)***				
(127) Pekin Sewer Site, SE NW NE, Sec. 7, T24N R4W				
	ISGS-661	27,230±420	Robein M	Liu and Coleman 1981
	ISGS-662	26,100±170	Robein M	Liu and Coleman 1981
Union County				
(128) Miller's Farm, NW SW SE, Sec. 7, T12S R2W				
	ISGS-649	20,160±250	Equality F	Liu and Coleman 1981
Vermilion County				
(129) Harmattan Strip Mine no. 4, NE NE NW, Sec. 4, T19W R12N				
	ISGS-83	20,500±210	Morton T	Johnson et al. 1972, Coleman 1973
	ISGS-81	20,800±130	Tiskilwa F, Oakland facies	Coleman 1973
(130) Higginsville, SW SE NE, Sec. 26, T21N R13W				
	ISGS-63	48,100±1,700	Robein M	Johnson et al. 1972, Coleman 1973
Warren County				
(131) Kirkwood, SW SE SE, Sec. 32, T11N R3W				
	I-1719	16,000±340	Peoria S	Frye et al. 1968
Whiteside County				
(132) Garden Plain, SE SE NE, Sec. 3, T20N R3E				
	ISGS-64	39,000±1,100	Robein M	Coleman 1973
	ISGS-98	41,900±1,300	Robein M	Coleman 1973
	ISGS-106	34,630±550	Robein M	Coleman 1973
(133) McAllister School, SE NE NE Sec. 33, T21N R5E				
	ISGS-6	27,500±500	Robein M	Kim and Ruch 1969
(134) Union Grove, SW NW NW, Sec. 10, T21N R4E				
	ISGS-97	37,420±710	Robein M	Coleman 1973
Winnebago County				
(135a) Oak Crest Bog, SE SW NE, Sec. 34, T45N R2E				
	ISGS-744	47,400±2,400	Robein M	McKenna 1985, Liu et al. 1986
	ISGS-749	33,220±710	Robein M	McKenna 1985, Liu et al. 1986
(135b) Oak Crest Bog, NE SE NE, Sec. 34, T45N R2E				
	ISGS-1039	24,830±350	Robein M	McKenna 1985, Liu et al. 1986
	ISGS-1045	43,100±1,100	Robein M	McKenna 1985, Liu et al. 1986
	ISGS-1069	43,800±2,700	Robein M	McKenna 1985, Liu et al. 1986
	ISGS-1073	37,900±1,300	Robein M	McKenna 1985, Liu et al. 1986
	ISGS-1156	38,210±930	Robein M	Unpublished
Woodford County				
(136) Sixmile Creek Test Boring, SW SW SE, Sec. 1, T25N R1E				
	I-2218	26,500±850	Robein M	Kempton et al. 1971
Lake Michigan (not shown in Figure 32)				
Lake Michigan Core 146-2, 32 km E of Waukegan, IL				
	ISGS-33	6920±200	L. Michigan M	Coleman 1972

Location no., site, Sec/Twp/Rge	Lab no.	Age	Lithostratigraphic unit	Reference
Lake Michigan *(cont)*				
Lake Michigan Core 143-2 and 144-2, 2 cores 52 and 45 km E of Waukegan, IL				
	ISGS-36	7,050±200	L. Michigan M	Coleman 1972
Lake Michigan Core 212-2, 54 km ENE of Waukegan, IL				
	ISGS-68	3,460±210	L. Michigan M	Coleman 1973
Lake Michigan Core 836-5, 19 km SW of Benton Harbor, MI				
	ISGS-208	8,075±95	L. Michigan M	Coleman and Liu 1975
Lake Michigan Core 800-5 Series, 53 km E of Zion, IL				
	ISGS-152	3,890±120	L. Michigan M	Coleman 1974
	ISGS-153	3,050±120	L. Michigan M	Coleman 1974
	ISGS-154	5,620±140	L. Michigan M	Coleman 1974
	ISGS-155	7,460±150	L. Michigan M	Coleman 1974
	ISGS-156	2,243±76	L. Michigan M	Coleman 1974
	ISGS-158	3,390±150	L. Michigan M	Coleman 1974
	ISGS-159	2,770±230	L. Michigan M	Coleman 1974
Lake Michigan Core 1000-3C, 25 km NW of Benton Harbor, MI				
	ISGS-219	4,070±130	L. Michigan M	Coleman and Liu 1975
	ISGS-220	5,140±160	L. Michigan M	Coleman and Liu 1975
	ISGS-234	4,400±200	L. Michigan M	Coleman and Liu 1975
Olson Site, Lake Michigan, 25 km ESE of Chicago Harbor, IL				
	ISGS-2036	8,120±100	L. Michigan M	Chrzastowski et al. 1991
	Beta-34357	8,380±100	L. Michigan M	Chrzastowski et al. 1991
	ISGS-2095	8,320±70	L. Michigan M	Chrzastowski et al. 1991
	ISGS-2096	8,320±70	L. Michigan M	Chrzastowski et al. 1991
Core Site 9, Lake Michigan, 20 km E of Waukegan, IL				
	WGH-469*	9,140±90	L. Michigan M	Colman et al. 1990
	WGH-471*	7,380±70	L. Michigan M	Colman et al. 1990
	WGH-472*	6,250±70	L. Michigan M	Colman et al. 1990
	WGH-473*	5,360±70	L. Michigan M	Colman et al. 1990
	WGH-489*	9,430±80	L. Michigan M	Colman et al. 1990
	WGH-534*	6,920±60	L. Michigan M	Colman et al. 1990
	WGH-536*	8,280±70	L. Michigan M	Colman et al. 1990
	WGH-537*	10,200±70	L. Michigan M	Colman et al. 1990
	WGH-632*	550±50	L. Michigan M	Colman et al. 1990
	WGH-633*	5,820±60	L. Michigan M	Colman et al. 1990
	WGH-635*	10,100±90	L. Michigan M	Colman et al. 1990
	WGH-636*	7,820±90	L. Michigan M	Colman et al. 1990
	WGH-637*	11,200±90	L. Michigan M	Colman et al. 1990

*Radiocarbon age determined by accelerator mass spectrometry

APPENDIX B2
Radiocarbon Ages for Mason and Wedron Group Units*
(classified by lithostatigraphic unit; site located by number on fig. 33)

Site, county (location no.)	Lab no.	Age	Material	Reference
Roxana Silt				
Pleasant Grove School, Madison (80)				
	W-729	35,200±1,000	Shell	Rubin and Alexander 1960
Gale, Alexander (1)				
	W-869	37,000±1,500	Shell	Rubin and Alexander 1960
Ni 323-335, Macon (72)				
	ISGS-25	>33,000	Organic silt	Grüger 1972b, Kim 1970
French Village, St. Clair (108)				
	ISGS-157	35,750±760	Shell	Coleman 1974
Canteen Creek, St. Clair (107)				
	ISGS-392	36,100±550	Organic silt	McKay 1979a Liu and Coleman 1981
	ISGS-393	40,200±1,500	Wood fragments	McKay 1979a Liu and Coleman 1981
Bunkum Borrow Pit, St. Clair (106)				
	ISGS-400	30,980±400	Shell	Liu and Coleman 1981
GR-1, Greene (38)				
	AA-7318	>37,000	Shell	Leigh and Knox 1993
Robein Member, Roxana Silt (beneath Wedron Group)				
Farm Creek, Tazewell (122)				
	W-68	22,900±900	Organic silt	Suess 1954
	W-69	25,100±800	Organic silt	Suess 1954
	ISGS-533	26,680±380	Organic silt, wood	Follmer et al. 1979 Liu and Coleman 1981
	ISGS-535	27,700±770	Organic silt, wood	Follmer et al. 1979 Liu and Coleman 1981
East Bureau Creek, Bureau (3)				
	W-333	25,700±800	Wood	Rubin and Alexander 1958
	W-642	26,200±800	Wood	Rubin and Alexander 1960
Danvers (Rock Creek), McLean (92)				
	W-406	26,150±700	Wood	Rubin and Alexander 1958
	ISGS-12	23,900±200	Wood fragments	Kim 1970
B-3, McHenry (85)				
	I-847	38,000±3000	Peat	Kempton and Hackett 1968a
B-8, McHenry (86)				
	I-849	25,600±800	Organic silt, peat	Kempton and Hackett 1968a Hansel and Johnson 1992
NIPC-5, McHenry (88)				
	I-1624	25,300±1,100	Organic silt, peat	Kempton and Hackett 1968a Hansel and Johnson 1992
B-13, Kane (53)				
	I-1625	26,900±1,500	Organic silt, peat	Kempton and Hackett 1968a
Sixmile Creek Test Boring, Woodford (136)				
	I-2218	26,500±850	Organic silt	Kempton et al. 1971
LeRoy Boring 4, McLean (93)				
	I-2220	27,200±950	Organic silt	Kempton et al. 1971
Farmer City, De Witt (25)				
	I-2517	21,950±500	Organic silt	Kempton et al. 1971
Observatory Boring 3, Douglas (26)				
	I-2519	20,000±400	Organic silt	Kempton and Gross 1971

*Samples are classified with the appropriate lithostratigraphic unit in the revised classification presented here on the basis of our reevaluation of the original section/core descriptions.

Site, county (location no.)	Lab no.	Age	Material	Reference
Robein Member, Roxana Silt (beneath Wedron Group) ***(cont)***				
NIPC-19, Cook (21)				
	I-2783	23,000±2,000	Organic silt, peat	Kempton and Hackett 1968b
Test Hole ISGS-3-67, McLean (94)				
	I-2785	24,600±750	Organic silt	Kempton and Gross 1971
Shelby County Moraine, Shelby (120)				
	ISGS-26	20,000±200	Peat	Kim 1970 Johnson et al. 1971a
	ISGS-32	21,300±500	Wood	Kim 1970 Johnson et al. 1971a
	ISGS-46	21,400±1,000	Peat, wood fragments	Coleman 1972 Johnson et al. 1971a
Charleston Quarry, Coles (16)				
	ISGS-28	21,300±500	Wood fragments	Kim 1970
	ISGS-2593	20,050±170	Tree trunk	Unpublished
	ISGS-2842	19,980±150	Tree trunk	Unpublished
	ISGS-2918	19,340±180	Wood litter	Unpublished
	ISGS-2919	20,660±170	Organic silt	Unpublished
Tuscola Borrow Pit, Douglas (27)				
	ISGS-37	30,700±500	Organic silt	Coleman 1972
Higginsville, Vermilion (130)				
	ISGS-63	48,100±1,700	Wood fragments	Johnson et al. 1972 Coleman 1973
Mahomet SW, Champaign (12)				
	ISGS-79	21,670±130	Wood	Coleman 1973
Center School, Coles (15)				
	ISGS-89	20,500±130	Wood	Johnson et al. 1972 Coleman 1973
	ISGS-2921	20,030±150	Wood fragments	Unpublished
	ISGS-2922	20,090±150	Wood fragments, silt	Unpublished
	ISGS-2923	20,440±160	Organic silt	Unpublished
	ISGS-2924	21,950±180	Organic silt	Unpublished
	ISGS 3099	21,680±520	Organic silt	Unpublished
Oakland 70F17, Coles (18)				
	ISGS-93	26,900±1,100	Organic silt	Coleman 1973
Test Boring 13-42-7, Kane (60)				
	ISGS-127	25,230±570	Organic silt	Coleman 1974 Hansel and Johnson 1992
Carpentersville Pit, Kane (55)				
	ISGS-238	37,600±1,300	Wood	Coleman and Liu 1975 Wickham et al. 1988
Monticello Borrow Pit, Piatt (100)				
	ISGS-408	28,970±290	Organic silt	Liu and Coleman 1981
	ISGS-422	22,850±290	Organic silt	Liu and Coleman 1981
	ISGS-423	37,950±700	Organic silt	Liu and Coleman 1981
	ISGS-490	34,290±840	Organic silt	Curry 1989
Gardena, Tazewell (125)				
	ISGS-529	25,690±280	Wood	Follmer et al. 1979 Liu and Coleman 1981
Big Rock Creek, Kendall (66)				
	ISGS-557	40,580±1,100	Organic silt	Liu and Coleman 1981
	ISGS-559	40,400±1,400	Organic silt	Liu and Coleman 1981
Malden South II, Bureau (4)				
	ISGS-614	27,300±540	Wood	Liu and Coleman 1981
ISGS Test Site DAA-19, Coles (17)				
	ISGS-681	32,620±650	Organic silt	Liu et al. 1986
	ISGS-686	25,170±150	Organic silt	Liu et al. 1986

Site, county (location no.)	Lab no.	Age	Material	Reference
Robein Member, Roxana Silt (beneath Wedron Group) ***(cont)***				
TA-3, S-7, Macon (74)				
	ISGS-723	20,870±130	Organic silt, wood	Liu et al. 1986
TA-6, S-9, Macon (75)				
	ISGS-727	21,250±170	Organic silt	Liu et al. 1986
Wedron Quarry, La Salle (68)				
	ISGS-862	24,900±200	Wood fragments	Johnson et al. 1985 Liu et al. 1986
Woodland Landfill, Kane (62)				
	ISGS-1113	26,890±400	Organic silt	Wickham et al. 1988
Mansfield Borrow Pit, Piatt (99)				
	ISGS-1123	21,360±720	Wood fragments	Unpublished
Fermi-4, Kane (58)				
	ISGS-1295	36,600±3,200	Organic silt	Curry 1989
	ISGS-1296	27,250±340	Organic silt	Curry 1989
Van Acker Gravel Pit, Kane (61)				
	ISGS-1339	37,100±2,000	Organic silt	Unpublished
Possum Run Pit, McHenry (89)				
	ISGS-1412	41,800±2,000	Peat	Unpublished
Elburn Forest Preserve S-30, Kane (56)				
	ISGS-1593	26,610±390	Peat	Curry 1989
	ISGS-1594	41,000±3,100	Organic silt	Curry 1989
Sleepy Hollow Core, McHenry (64)				
	ISGS-2049	33,500±690	Organic silt	Unpublished
Hebron Core MC-8, McHenry (87)				
	ISGS-2602	26,030±450	Organic silt	Curry and Pavich 1994
Roxana Silt, Robein Member (beyond Wedron Group margin)				
Virginia, Cass (11)				
	W-526	29,000±1,200	Wood	Rubin and Alexander 1960
Enion, Fulton (31)				
	W-745	23,500±400	Stems, twigs	Rubin and Alexander 1960
Buckheart Strip Mine, Fulton (30)				
	W-849	23,700±550	Wood fragments	Rubin and Alexander 1960
	W-853	25,500±600	Wood fragments	Rubin and Alexander 1960
McAllister School, Whiteside (133)				
	ISGS-6	27,500±500	Peat	Kim and Ruch 1969
P-3866, Macon (73)				
	ISGS-21	25,500±600	Peat	Kim 1970 Grüger 1972b
Stockton NE Core 2, Jo Daviess (52)				
	ISGS-24	27,200±400	Organic silt	Kim 1970
	ISGS-30	26,300±400	Organic silt	Kim 1970
Edwardsville, Madison (79)				
	ISGS-39	20,000±500	Organic silt	Kim 1970
	ISGS-45	21,350±320	Gastropod	Kim 1970
Garden Plain, Whiteside (132)				
	ISGS-64	39,000±1,100	Organic silt	Coleman 1973
	ISGS-98	41,900±1,300	Organic silt	Coleman 1973
	ISGS-106	34,630±550	Organic silt	Coleman 1973
Fancy Prairie, Menard (96)				
	ISGS-90	24,450±280	Muck, wood	Coleman 1973
Union Grove, Whiteside (128)				
	ISGS-97	37,420±710	Organic silt	Coleman 1973
Sugar Creek Valley Boring 8, Sangamon (118)				
	ISGS-99	22,700±110	Organic silt	Coleman 1973

Site, county (location no.)	Lab no.	Age	Material	Reference
Roxana Silt, Robein Member (beyond Wedron Group margin) ***(cont)***				
Sangamon River Valley Boring 9, Sangamon (115)	ISGS-102	24,640±430	Organic silt	Coleman 1973
Sangamon River Valley No. 36, Sangamon (117)	ISGS-107	22,020±300	Organic silt	Coleman 1974
Sangamon River Valley Boring 10, Sangamon (116)	ISGS-108	22,150±330	Organic silt	Miller 1973, Coleman 1974
Sangamon River Valley Boring 7, Menard (97)	ISGS-110	20,740±720	Organic silt	Miller 1973, Coleman 1974
Cass A, Cass (6)	ISGS-122	24,980±420	Wood fragments	Coleman 1974
Cass B, Cass (7)	ISGS-123	21,080±370	Wood fragments	Coleman 1974
E-W Tollway Boring 64, Lee (70)	ISGS-125	22,190±960	Wood fragments	Coleman 1974
P-7681A, Henderson (48)	ISGS-136	20,320±120	Wood fragments	Coleman 1974
Lomax, Henderson (47)	ISGS-261	21,250±220	Organic silt	Liu and Coleman 1981
	ISGS-1635	26,840±470	Organic silt	Curry and Follmer 1992
	ISGS-1637	28,900±1,500	Wood	Curry and Follmer 1992
	ISGS-1720	24,720±320	Organic silt	Curry and Follmer 1992
	ISGS-1730	21,250±250	Organic silt	Curry and Follmer 1992
	ISGS-2110	20,410±210	Organic silt	Unpublished
Mt. Morris Core, Ogle (98)	ISGS-374	35,600±1,000	Organic silt	Liu and Coleman 1981
Airport West, Rock Island (102)	ISGS-375	41,200±1,600	Organic silt	Liu and Coleman 1981
	ISGS-476	26,180±800	Organic silt	Liu and Coleman 1981
Athens North Quarry, Menard (95)	ISGS-536	25,170±200	Muck	Follmer et al. 1979 Liu and Coleman 1981
	ISGS-654	38,920±1,100	Peat	Liu and Coleman 1981 Follmer 1983 Curry and Follmer 1992
	ISGS-870	35,750±620	Organic silt	Liu et al. 1986 Curry and Follmer 1992
	ISGS-883	37,100±1200	Organic silt	Curry and Follmer 1992
	ISGS-1859	43,800±3,000	Organic silt	Curry and Follmer 1992
	ISGS-1860	32,800±3,200	Organic silt	Curry and Follmer 1992
	ISGS-1861	21,190±460	Organic silt	Curry and Follmer 1992
	ISGS-1873	29,220±630	Organic silt	Curry and Follmer 1992
	ISGS-1878	27,770±450	Organic silt	Curry and Follmer 1992
	ISGS-1879	28,090±470	Organic silt	Curry and Follmer 1992
	ISGS-1880	28,240±460	Organic silt	Curry and Follmer 1992
	ISGS-1883	28,440±310	Organic silt	Curry and Follmer 1992
	ISGS-1888	29,620±630	Organic silt	Curry and Follmer 1992
	ISGS-1889	34,230±710	Organic silt	Curry and Follmer 1992
	ISGS-1897	27,330±290	Organic silt	Curry and Follmer 1992
	ISGS-1904	36,800±1,200	Organic silt	Curry and Follmer 1992
	ISGS-1905	31,110±450	Humic acid	Curry and Follmer 1992
	ISGS-1910	36,930±770	Organic silt	Curry and Follmer 1992
Troy Auger 12.0, Madison (83)	ISGS-575	26,050±330	Muck, wood	Liu and Coleman 1981
Amboy West, Lee (69)	ISGS-624	37,290±790	Organic silt	Liu and Coleman 1981

Site, county (location no.)	Lab no.	Age	Material	Reference
Roxana Silt, Robein Member (beyond Wedron Group margin) ***(cont)***				
Pekin Sewer Site, Tazewell (126)				
	ISGS-661	27,230±420	Wood fragments	Liu and Coleman 1981
	ISGS-662	26,100±170	Wood fragments	Liu and Coleman 1981
Oak Crest Bog, Winnebago (135)				
	ISGS-744	47,400±2,400	Peat	McKenna 1985 Liu et al. 1986
	ISGS-749	33,220±710	Organic silt	McKenna 1985 Liu et al. 1986
	ISGS-1039	24,830±350	Organic silt	McKenna 1985 Liu et al. 1986
	ISGS-1045	43,100±1,100	Peat	McKenna 1985 Liu et al. 1986
	ISGS-1069	43,800±2,700	Peat	McKenna 1985 Liu et al. 1986
	ISGS-1073	37,900±1,300	Peat	McKenna 1985 Liu et al. 1986
	ISGS-1156	38,210±930	Peat	Unpublished
McKee Farm, McDonough (84)				
	ISGS-975	37,700±1,400	Organic silt	Liu et al. 1986
	ISGS-1041	25,269±280	Organic silt	Liu et al. 1986
	ISGS-1042	37,800±2,100	Organic silt	Liu et al. 1986
	ISGS-1133	34,920±590	Peat, organic silt	Unpublished
Biggsville Quarry, Henderson (46)				
	ISGS-1231	21,410±290	Organic silt	Baker et al. 1989
	ISGS-1522	23,230±710	Wood, peat	Unpublished
	Beta-4129	27,870±420	Wood	Baker et al. 1989
Peoria Silt (beyond margin of Wedron Group)				
Burdick Branch, Madison (77)				
	W-730	17,100±300	Shell	Rubin and Alexander 1960
Enion North, Fulton (32)				
	W-870	20,300±400	Shell	Rubin and Alexander 1960
Collinsville, Madison (78)				
	W-1055	17,950±550	Wood fragments	Ives et al. 1964
Kirkwood, Warren (131)				
	I-1719	16,000±340	Shell	Frye et al. 1968
Bald Bluff, Henderson (45)				
	I-1720	13,700±260	Shell	Frye et al. 1968
Cottonwood School South, Cass (9)				
	ISGS-137	15,640±580	Shell	Coleman 1974 Frye et al. 1974
	ISGS-138	10,410±650	Shell	Coleman 1974 Frye et al. 1974
Cottonwood School, Cass (8)				
	ISGS-195	12,740±210	Organic clay	Frye et al. 1974
	ISGS-1363	19,400±300	Shell	Unpublished
	ISGS-1364	17,600±320	Shell	Unpublished
	Beta-76811	20,730±90	Shell	Unpublished
Collinson Quarry, Rock Island (104)				
	ISGS-1365	18,420±360	Shell	Unpublished
Jules, Cass (9)				
	ISGS-179	15,020±300	Organic clay	Frye et al. 1974
Ruby Lane, St. Clair (109)				
	ISGS-294	21,910±270	Wood fragments	Liu and Coleman 1981
	ISGS-307	23,930±280	Wood fragments	Liu and Coleman 1981

Site, county (location no.)	Lab no.	Age	Material	Reference
Peoria Silt (beyond margin of Wedron Group) ***(cont)***				
Sugarloaf Road Core G-39, Madison (81)				
	ISGS-412	20,910±520	Wood, organic silt	Liu and Coleman 1981
	ISGS-413	23,110±800	Organic silt, wood	Liu and Coleman 1981
Canteen Creek, St. Clair (107)				
	ISGS-421	16,020±260	Organic clay	Liu and Coleman 1981
Athens North Quarry, Menard (95)				
	ISGS-534	22,170±450	Wood	Follmer et al. 1979 Liu and Coleman 1981 Curry and Follmer 1992
	ISGS-2981	20,880±370	Wood	Unpublished
	ISGS-3027	22,120±230	Wood	Unpublished
	ISGS-3028	23,560±300	Wood	Unpublished
	ISGS-3029	25,110±280	Wood	Unpublished
Coal Creek, Rock Island (103)				
	ISGS-1303	21,470±590	Wood	Unpublished
Olive Branch, Alexander (2)				
	ISGS-2507	20,230±510	Organic clay	Unpublished
Morton Tongue, Peoria Silt				
East Bureau Creek, Bureau (3)				
	W-334	22,450±1,000	Peat	Rubin and Alexander 1958
Farm Creek, Tazewell (122)				
	W-349	20,340±750	Wood	Rubin and Alexander 1958 Follmer et al. 1979
	W-399	20,700±650	Wood	Rubin and Alexander 1958 Follmer et al. 1979
	ISGS-2438,	20,840±250	Stump, inner	Unpublished
	ISGS-2485	20,550±280	Stump, outer	Unpublished
Danvers (Rock Creek), McLean (92)				
	W-483	20,500±600	Moss	Rubin and Alexander 1958
	ISGS-3100	20,500±600	Moss	Unpublished
Harmattan Strip Mine no. 4, Vermilion (129)				
	ISGS-83	20,500±210	Wood	Johnson et al. 1972 Coleman 1973
Gardena, Tazewell(125)				
	ISGS-530	25,680±1,000	Wood	Follmer et al. 1979 Liu and Coleman 1981
	ISGS-531	25,370±310	Wood	Follmer et al. 1979 Liu and Coleman 1981
	ISGS-532	19,680±460	Moss	Follmer et al. 1979 Liu and Coleman 1981 Hansel and Johnson 1992
Clinton Power Plant, De Witt (24)				
	ISGS-828	20,670±280	Moss	Liu et al. 1986
Getz Borrow Pit, Tazewell (126)				
	ISGS-2047,	20,020±230	Log	Unpublished
	ISGS-2048	20,720±490	Log	Unpublished
Hebron Core MC-8, McHenry (87)				
	ISGS-2601	24,780±360	Wood fragments	Curry and Pavich 1994
Peoria Silt (above Wedron Group)				
Sunnycrest Drainage Ditch, Champaign (13)				
	ISGS-767	17,690±270	Wood fragments	Liu et al. 1986 Hansel and Johnson 1992

Site, county (location no.)	Lab no.	Age	Material	Reference
Equality Formation (beyond Wedron Group margin)				
Pittsburg Basin, Fayette (29)				
	ISGS-47	21,370±810	Organic silty clay	Coleman 1972, Grüger 1972a
	ISGS-53	24,200±1,900	Organic silty clay	Coleman 1972, Grüger 1972a
	ISGS-65	24,200±800	Organic silt	Grüger 1972a, Coleman 1973
	ISGS-67	34,000±1,200	Organic silt	Grüger 1972a, Coleman 1973
	ISGS-71	37,200±900	Organic silt	Grüger 1972a, Coleman 1973
	ISGS-738	32,590±930	Peaty gyttja	Liu et al. 1986
	ISGS-748	39,800±1,200	Peaty gyttja	Liu et al. 1986
	ISGS-750	40,030±990	Peaty gyttja	Liu et al. 1986
	ISGS-742	41,110±810	Peaty gyttja	Liu et al. 1986
Big Ridge, Saline (111)				
	ISGS-84	20,600±220	Wood	Coleman 1973
	ISGS-87	20,900±140	Peat	Coleman 1973
Little Cypress Ditch, Gallatin (37)				
	ISGS-88	17,510±330	Organic clayey sand	Coleman 1973
	ISGS-95	23,500±960	Organic clayey sand	Coleman 1973
	ISGS-96	19,160±690	Organic clayey sand	Coleman 1973
Big Cypress Ditch, Gallatin (35)				
	ISGS-101	12,780±100	Shell	Coleman 1973
	ISGS-103	13,030±190	Shell	Coleman 1973
Sangamon River Valley Boring 4, Sangamon (113)				
	ISGS-109	17,650±450	Organic silt	Miller 1973, Coleman 1974
Lomax, Henderson (47)				
	ISGS-136	20,320±120	Wood	Coleman 1974 Curry and Follmer 1992
Koster, Greene (41)				
	ISGS-415	12,325±75	Wood fragments	Liu et al. 1986
	ISGS-875	13,360±100	Wood	Wiant et al. 1983
Miller's Farm, Union (128)				
	ISGS-649	20,160±250	Wood fragments	Liu and Coleman 1981
Edwards Farm, Gallatin (36)				
	ISGS-546	21,460±210	Organic silty clay	Liu and Coleman 1981
Mitchell Farm, Hamilton (43)				
	ISGS-547	20,510±170	Organic clayey silt	Liu and Coleman 1981
Barnes Farm, Saline (110)				
	ISGS-549	21,780±410	Organic silt	Liu and Coleman 1981
Zipp Profile no. 23, Hamilton (44)				
	ISGS-560	20,830±160	Organic silt	Liu and Coleman 1981
Smiling Dan, Scott (119)				
	ISGS-851	23,380±500	Wood fragments	Hajic 1985
Nutwood Levee District, Jersey (50)				
	ISGS-894	13,390±190	Wood	Liu et al. 1986
Nutwood Levee District, Jersey (51)				
	ISGS-1135	9,480±130	Wood	Hajic 1990
Hartwell Levee District, Greene (39)				
	ISGS-900	13,010±140	Wood	Liu et al. 1986
Hillview Levee District, Greene (40)				
	ISGS-1122	9,300±150	Wood fragments	Hajic 1990
Rice Lake, Fulton (34)				
	ISGS-1379	15,000±240	Wood	Unpublished
Metz Creek, Calhoun (5)				
	ISGS-1531	13,710±270	Wood fragments	Hajic 1990
Kearney Cemetery, Fulton (33)				
	ISGS-1721	20,400±190	Wood fragments	Hajic 1990

Site, county (location no.)	Lab no.	Age	Material	Reference
Equality Formation (beyond Wedron Group margin) ***(cont)***				
New De Kalb Water Tower, De Kalb (23)				
	ISGS-2111	14,050±150	Wood, organic silt	Unpublished
Peddicord Tongue, Equality Formation				
Wedron Quarry, La Salle (68)				
	W-79	24,000±700	Wood	Suess 1954
	W-871	26,800±700	Wood	Rubin and Alexander 1960 Willman and Frye 1970
	ISGS-863	24,370±310	Wood	Johnson et al. 1985a Liu et al. 1986 Hansel and Johnson 1992
Morris North, Grundy (42)				
	ISGS-61	24,990±280	Wood	Willman et al. 1971 Coleman 1973
Unnamed tongue, Equality Formation				
Wedgewood, HcHenry (90)				
	ISGS-3021	23,230±550	Organic Silt	Unpublished
Lake Michigan Member, Equality Formation				
Lake Michigan Core 146-2				
	ISGS-33	6,920±200	Organic clay	Coleman 1972
Lake Michigan Core 143-2 and 144-2				
	ISGS-36	7,050±200	Organic clay	Coleman 1972
Lake Michigan Core 212-2				
	ISGS-68	3,460±210	Organic silt	Coleman 1973
Lake Michigan Core 836-5				
	ISGS-208	8,075±95	Organic silt	Coleman and Liu 1975
Lake Michigan Core 800-5 Series				
	ISGS-152	3,890±120	Organic clay	Coleman 1974
	ISGS-153	3,050±120	Organic clay	Coleman 1974
	ISGS-154	5,620±140	Organic clay	Coleman 1974
	ISGS-155	7,460±150	Organic clay	Coleman 1974
	ISGS-156	2,243±76	Organic clay	Coleman 1974
	ISGS-158	3,390±150	Organic clay	Coleman 1974
	ISGS-159	2,770±230	Organic clay	Coleman 1974
Lake Michigan Core 1000-3C				
	ISGS-219	4,070±130	Organic clay	Coleman and Liu 1975
	ISGS-220	5,140±160	Organic clay	Coleman and Liu 1975
	ISGS-234	4,400±200	Organic clay	Coleman and Liu 1975
Olson Site, Lake Michigan, 25 km ESE of Chicago Harbor, IL				
	ISGS-2036	8120±100	Oak stump	Chrzastowski et al. 1991
	Beta-34357	8,380±100	Oak stump	Chrzastowski et al. 1991
	ISGS-2095	8,320±70	Ash stump	Chrzastowski et al. 1991
	ISGS-2096	8,320±70	Oak stump	Chrzastowski et al. 1991
Core Site 9, Lake Michigan, 20 km E of Waukegan, IL				
	WGH-469**	9,140±90	Bivalves	Colman et al. 1990
	WGH-471**	7,380±70	Bivalves	Colman et al. 1990
	WGH-472**	6,250±70	Bivalves	Colman et al. 1990
	WGH-473**	5,360±70	Bivalves	Colman et al. 1990
	WGH-489**	9,430±80	Bivalves	Colman et al. 1990
	WGH-534**	6,920±60	Bivalves	Colman et al. 1990
	WGH-536**	8,280±70	Bivalves	Colman et al. 1990

**Radiocarbon age determined by accelerator mass spectrometry

Site, county (location no.)	Lab no.	Age	Material	Reference
Lake Michigan Member, Equality Formation *(cont)*				
Core Site 9, Lake Michigan, 20 km E of Waukegan, IL *(cont)*				
	WGH-537**	10,200±70	Organic mud	Colman et al. 1990
	WGH-632**	550±50	Organic mud	Colman et al. 1990
	WGH-633**	5.820±60	Organic mud	Colman et al. 1990
	WGH-635**	10,100±90	Organic mud	Colman et al. 1990
	WGH-636**	7.820±90	Organic mud	Colman et al. 1990
	WGH-637**	11,200±90	Organic mud	Colman et al. 1990
Equality Formation (above Wedron Group)				
Parkland College, Champaign (14)				
	ISGS-69	13,980±200	Peat	Coleman 1973
Chatsworth (Strawn) Bog, Livingston (71)				
	ISGS-527	14,380±150	Marly organic clay	Liu and Coleman 1981 King 1986
Du Page Mammoth Site, DuPage (28)				
	ISGS-465	15,240±120	Peat, clay	Liu et al. 1986 Hansel and Johnson 1992
	ISGS-485	13,130±350	Mastodon bone	Liu et al. 1986
NIU-28 Series, La Salle (67)				
	ISGS-482	12,410±130	Wood	Liu et al. 1986
	ISGS-483	11,080±350	Wood	Liu et al. 1986
	ISGS-489A	10,890±210	Mastodon bone, apatite fraction	Liu et al. 1986
	ISGS-489B	10,990±110	Mastodon bone, total organic carbon	Liu et al. 1986
Biddle Farm, Kane (54)				
	ISGS-2079	13,530±100	Wood fragments	Unpublished
	ISGS-2981	13,590±230	Organic clay	Unpublished
	ISGS-2083	12,380±140	Organic clay	Unpublished
Nelson Lake Core (63)				
	AA-4680**	14,780±150	Spruce needles	Unpublished
Henry Formation (beyond Wedron Group)				
Kearney Cemetery, Fulton (33)				
	W-381	15,600,±600	Wood	Rubin and Alexander 1956
Reynolds School, Rock Island (105)				
	ISGS-78	16,160±140	Wood	Coleman 1973
Sangamon River Valley Boring 8, Sangamon (114)				
	ISGS-118	29,140±270	Wood fragments	Coleman 1974
Sunset Hills, Madison (82)				
	ISGS-128	19,900±1300	Wood fragments	Coleman 1974
	ISGS-129	19,750±500	Wood fragments	Coleman 1974
Clores Bridge, Randolph (101)				
	ISGS-331	15,330±170	Wood fragments	Liu and Coleman 1981
Geneseo Landfill Core, Henry (49)				
	ISGS-426	13,300±240	Wood fragments	Liu and Coleman 1981
Stubbe Farm, Stephenson (121)				
	ISGS-561	26,820±200	Peat	Liu and Coleman 1981 Whittecar and Davis 1982
	ISGS-479	31,400±740	Peat	Liu and Coleman 1981 Whittecar and Davis 1982
	ISGS-562	40,500±1,700	Peat	Liu and Coleman 1981 Whittecar and Davis 1982
C-502, Sangamon (112)				
	ISGS-673	33,000±1,000	Wood	Liu et al. 1986

Site, county (location no.)	Lab no.	Age	Material	Reference
Ashmore Tongue, Henry Formation ***(cont)***				
Charleston Quarry, Coles (16)				
	ISGS-27	19,500±200	Wood	Kim 1970
Wedron Quarry, La Salle (68)				
	ISGS-1486	21,460±470	Wood fragments	Garry et al. 1990 Hansel and Johnson 1992
	ISGS-2484	21,370±240	Wood	Unpublished
Parkland facies, Henry Formation				
SE Kankakee County Dune Field, Kankakee (65)				
	ISGS-271	12,990±120	Sandy peat	Liu and Coleman 1981
Lomax, Henderson (47)				
	ISGS-1832	17,240±190	Wood fragments	Curry and Follmer 1972
Henry Formation (above Wedron Group)				
RMM-1, Macon (76)				
	ISGS-80	13,090±110	Peat	Coleman 1973
Elgin Bog, Cook (19)				
	ISGS-1550	14,330±250	Wood	Hansel and Johnson 1992
Sleepy Hollow Core, McHenry (64)				
	ISGS-2054	13,670±140	Organic sand, wood	Unpublished
Dolton facies, Henry Formation (above Wedron Group)				
Lynwood Reservoir, Cook (20)				
	ISGS-1549	13,870±170	Driftwood	Hansel and Johnson 1992
	ISGS-1570	14,100±640	Driftwood	Hansel and Johnson 1992
Tinley Park, Cook (21)				
	ISGS-1649	13,890±120	Wood fragments	Hansel and Johnson 1992
Tiskilwa Formation				
Browkaw Hospital Boring 4, McLean (91)				
	I-2518	22,450±500	Organic silt	Kempton et al. 1971
Wedron Quarry, La Salle (68)				
	ISGS-31	25,900±500	Wood	Kim 1970
Fox River Stone Company, Kane (59)				
	ISGS-1872	29,500±1,000	Wood	Unpublished
Oakland facies, Tiskilwa Formation				
Harmattan Strip Mine no. 4, Vermilion (129)				
	ISGS-81	20,800±130	Wood	Coleman 1973
Oakland 70F17, Coles (18)				
	ISGS-94	24,600±1,300	Organic silt	Coleman 1973
Feltes Pit, Kane (57)				
	ISGS-2108	23,710±320	Wood	Unpublished
Farmdale Dam, Tazewell (123)				
	W-187	19,200±700	Wood fragments	Rubin and Suess 1955
Farmdale Railroad Cut, Tazewell (124)				
	W-524	18,460±500	Wood	Rubin and Alexander 1960

APPENDIX C
Reference Sections for the Wedron and Mason Groups Units

Unpublished descriptions for reference sections are included
Previously published descriptions for sections are cited.
Nomenclatural and classification changes from previously published descriptions are listed.

Arenzville Section

Reference section for the Roxana Silt. Follmer et al. 1979.

Located in borrow pit on east side of road, 5 miles (8 km) north and 2 miles (3.2 km) east of Arenzville, Illinois. NW NW SW Section 10, T17N, R11W, Arenzville East 7.5-minute quadrangle, Cass County, Illinois.

Replace Peoria Loess with Peoria Silt.

Athens North Quarry Section

Reference section for the Roxana Silt, the Robein Member of the Roxana Silt, the Peoria Silt. Follmer et al. 1979.

Located in the north highwall of limestone quarry, 5 miles (8 km) northeast of Athens, Illinois. SW SE NE Section 18, T18N, R5W, Mason City Southwest 7.5-minute quadrangle, Menard County, Illinois.

Replace Peoria Loess with Peoria Silt; Robein Silt with Robein Member, Roxana Silt.

Bellefontaine Quarry Section

Reference section for the Peoria and Roxana Silts.

Section measured in southwest corner of large quarry. Section is about 2,300 feet (701 m) southwest of the bank of the Missouri River; 3300'W (,1006 m) and 4900'N (1,494 m) of the SE corner, Section 9, T47N, R7E, Columbia Bottom, Missouri-Illinois 7.5-minute quadrangle, St. Louis County, Missouri. Surface elevation, 520 feet (158.5 m). Description by David A. Grimley 1991.

Lithostratigraphic Unit	Thickness ft	m*
Peoria Silt		
Silt loam, platy to fine blocky structure, dark yellow brown (9YR4/4), leached; (AE,E, and BE horizons of modern soil)	1.0	.3
Heavy silt loam, strong blocky structure, clay skins, mostly brown (8YR4/4) and some dark yellow brown (10YR4.5/4) in matrix, leached; (Bt and BC horizons of modern soil)	3.3	1.0
Silt loam, weak crumb to massive structure, dark yellow brown (10YR4/4), leached; (CB horizon of modern soil)	7.9	2.4
Heavy silt loam, granular structure, dark brown (10YR3/3), leached; (A horizon of Jules interstadial soil)	0.1	.03
Silt loam, weak crumb to massive structure, light yellow brown (10YR6/4) to yellow brown (10YR5/4), lowest meter strongly dolomitic, low MS (30's, 40's, low 50's); (C horizon loess)	4.0	1.3
Silt loam, weak crumb to massive structure, yellow brown (10YR6/4), moderately dolomitic, high MS (60's); (C horizon loess)	3.3	1.0
Silt loam, weak, fine granular structure, dark yellow brown (10YR4/4), weakly dolomitic, high MS (60's); (CA horizon of Farmdale Geosol)	0.6	.2
Roxana Silt		
Meadow Member		
Silt loam, weak crumb to massive structure, brown (7.5YR4/4), leached, high MS (60's, 70's); (CB horizon of Farmdale Geosol)	8.5	2.6

*Unit of original field measurements

Markham Member		
Silt loam, weak granular structure, dark yellow brown (9YR4/4), leached, moderate (50's, 60's); (CA horizon of Sangamon Geosol)	2.6	.8
Teneriffe Silt		
Silt loam, strong crumb to fine blocky structure, strong brown (7.5YR4/6), leached, minor amounts of sand; (A and BA horizons of Sangamon Geosol)	0.6	.2
Pearl Formation		
Clay loam, strong blocky structure, many clay skins, dark red (4YR3.5/6), leached, contains abundant, medium to coarse sand, becoming more gravelly at base (cherty), lower contact of Pearl Formation not described; (Bt horizon of Sangamon Geosol)	1.3	>.4
Total	33.5	10.3

Beverly Sand and Gravel Pit Section

Type section for the Beverly Tongue of the Henry Formation. Hansel et al. 1985a, Hansel and Johnson 1986.

Reference section for the Lemont Formation, the Haeger Member of the Lemont Formation, intertonguing relationship of the Henry Formation with the Wedron Group. Hansel et al. 1985a, Hansel and Johnson 1986.

Located in the Beverly Sand and Gravel Pit, about 1.5 miles (2.4 km) east of the intersection on Interstate 90 and Highway 25 northeast of Elgin. Section 31, T42N, R9E, Streamwood 7.5-minute quadrangle, Cook County, Illinois.

Replace Richland Loess with Peoria Silt; Haeger Till Member, Wedron Formation with Beverly Tongue, Henry Formation and Haeger Member, Lemont Formation; Yorkville Till Member, Wedron Formation with Yorkville Member, Lemont Formation.

Buda East Section

Type section for the Tiskilwa Formation. Roadcut, no longer exposed. Willman and Frye 1970.

Located in roadcut, 5 miles northwest of Tiskilwa, SE SE SW Section 31, T16N, R8E, Wyanet 7.5-minute quadrangle, Bureau County, Illinois.

Replace Richland Loess with Peoria Silt; Tiskilwa Till Member, Wedron Formation with Tiskilwa Formation.

Car Dealer (Two Rivers Gravel Pit) Section

Type section for the Two Rivers Member of the Kewaunee Formation. Mickelson et al. 1984.

Located in sand and gravel pit behind Chevrolet dealership on east side of Highway 42 in the northern part of the city of Two Rivers. NW SW NW Section 31, T20N, R25E, Two Rivers 7.5-minute quadrangle, Manitowoc County, Wisconsin.

Cedarburg Lake Bluff Section

Reference section for the Wedron Group, the Wadsworth-equivalent Oak Creek Formation, the Kewaunee Formation, the Shorewood Member of the Kewaunee Formation. Bona et al., unpublished, Ronnert 1992, Hansel and Johnson 1992.

Located in lake bluff, approximately 6.4 kilometers (3.9 mi) east of town of Cedarburg on County Highway C in Wisconsin. SE SW SW Section 33, T10N, R22E, Cedarburg 7.5-minute quadrangle, Ozaukee County, Wisconsin.

Tongues of the Equality Formation are present between diamicton units of the Wadsworth-equivalent Oak Creek Formation and between diamicton units of the Oak Creek Formation and the Shorewood-equivalent Ozaukee Member of the Kewaunee Formation.

Charleston Section

Type section for the Ashmore Tongue of the Henry Formation. Ford 1973. Gutowski et al. 1991.

Reference section for the Robein Member of the Roxana Silt, the Peddicord Tongue of the Equality Formation, and intertonguing relationships of the Mason and Wedron Groups. Gutowski et al. 1991.

Located in the south wall of the Charleston Stone Quarry, approximately 500 feet (152 m) west of the Embarrass River and 100 feet (30 m) north of the railroad tracks. SW NW Section 5, T12N, R10E, Ashmore 7.5-minute quadrangle, Coles County, Illinois.

In Gutowski et al. (1991), replace Fairgrange Till Member, Wedron Formation with Delavan Member, Tiskilwa Formation; Henry Formation with Ashmore Tongue, Henry Formation; Morton Loess with Peddicord Tongue, Equality Formation; Robein Silt with Robein Member, Roxana Silt.

Core 5P, Lake Michigan

Reference section for the Lake Michigan Member of the Equality Formation. Core taken by USGS, description available in USGS Open-File Report 90-478. Part of core archived in USGS Woods Hole Oceanographic Institution's Core Storage Facility, Woods Hole, Massachusetts. Colman and Foster 1990.

Located about 68 kilometers (42.5 mi) west of South Haven, Michigan, at latitude 42°25.87'N, longitude 86°50.1'W, water depth 119 meters (390 ft), 0 to 700 centimeters (0–23 ft) depth.

Replace upper Lake Michigan Formation with Lake Michigan Member, Equality Formation; lower Lake Michigan Formation with Equality Formation.

Core 9V, Lake Michigan

Reference section for the Wadsworth and Equality Formations, the Lake Michigan Member, Equality Formation. Core taken by USGS, description available in Open-File Report 90-478. Part of core archived in USGS Woods Hole Oceanographic Institution's Core Storage Facility, Woods Hole, Massachusetts. Colman and Foster 1990.

Located about 20 kilometers (12.5 mi) east of Waukegan, Illinois, at latitude 42°23.8'N, longitude 87°33.2'W, water depth 77 meters (252 ft), 0 to 700 centimeters (0–23 ft) depth.

Replace upper Lake Michigan Formation with Lake Michigan Member, Equality Formation; lower Lake Michigan Formation with Equality Formation; Wadsworth Till Member, Wedron Formation with Wadsworth Formation.

Core 15V, Lake Michigan

Reference section for the Manitowoc Member of the Kewaunee Formation. Core taken by USGS, description available in Open-File Report 90-478. Part of core archived in USGS Woods Hole Oceanographic Institution's Core Storage Facility, Woods Hole, Massachusetts. Colman and Foster 1990.

Located about 25 kilometers (15.6 mi) east of Sheboygan, Wisconsin, at latitude 43°48.1'N, longitude 87°24.1'W, water depth 87 meters (285 ft), 514 to 779 centimeters (17–26 ft) in core.

Replace Manitowoc Till Member, Wedron Formation with Manitowoc Member, Kewaunee Formation.

Core 17V, Lake Michigan

Reference section for the Two Rivers Member of the Kewaunee Formation. Core taken by USGS, description available in Open-File Report 90-478. Part of core archived in USGS Woods Hole Oceanographic Institution's Core Storage Facility, Woods Hole, Massachusetts. Colman and Foster 1990.

Located 4 kilometers (2.5 mi) east of Port Washington, Wisconsin, at latitude 43°29.2'N, longitude 87°45.2'W, water depth 39 meters (128 ft), 192 to 308 centimeters (6–10 ft) in core.

Replace upper Lake Michigan Formation with Lake Michigan Member, Equality Formation; Two Rivers Till with Two Rivers Member, Kewaunee Formation.

Core 904, Lake Michigan

Type section for the Manitowoc Member of the Kewaunee Formation. Core chips archived in ISGS samples library. Lineback et al. 1974.

Located about 45 kilometers (27 mi) southeast of Manitowoc, Wisconsin, at latitude 43°45.0′N, longitude 87°22.2′W, water depth 95.4 meters (315 ft), 259 to 328 centimeters (8–11 ft) in core.

Replace Sheboygan and South Haven Members, Lake Michigan Formation and Carmi Member, Equality Formation with Equality Formation; Manitowoc Till Member, Wedron Formation with Manitowoc Member, Kewaunee Formation.

Core 911, Lake Michigan

Type section for the Shorewood Member of the Kewaunee Formation. Core chips archived in ISGS samples library. Lineback et al. 1974.

Located about 48 kilometers (29 mi) east of Shorewood, Wisconsin, at latitude 43°13.9′N, longitude 87°22.1′W, water depth 89.9 meters (296.7 ft), 82 to 221 centimeters (3–7 ft) in core.

Replace South Haven Member, Lake Michigan Formation with Equality Formation; Shorewood Till Member, Wedron Formation with Shorewood Member, Kewaunee Formation.

Core 4943, Psychology Building, U of I Campus, B-284, Champaign Co. 14

Reference section for the Piatt Member of the Tiskilwa Formation, the Batestown Member of the Lemont Formation. Core chips in ISGS samples library; grain size and clay mineral data on file.

Site characterization boring for Psychology Building. NE SE NW Section 18, T19N, R9E, Urbana 7.5-minute quadrangle, Champaign County, IL. Surface elevation 734 feet (220 m). Core chips description by J. P. Kempton (ISGS) 1970.

Lithostratigraphic Unit	Thickness ft*	m
Fill		
Sandy silt, black, massive, calcareous; (sample at 2.5 ft)	3	0.9
Equality Formation		
Slightly silty sand, dark brown, very fine horizontal laminae, few pebbles, calcareous; (lacustrine sediment) (sample at 5 ft)	4	1.2
Lemont Formation		
Batestown Member *Silt loam diamicton*, olive brown to olive gray, massive, few pebbles, calcareous; (till) (samples at 7.5, 10, 12.5, 15, 20 ft)	16	4.9
Silt loam diamicton, gray brown to olive gray, few pebbles, massive, calcareous; (till) (samples at 25, 30, 35 ft)	15	4.6
Tiskilwa Formation		
Piatt Member *Clay loam to loam diamicton*, gray brown, few pebbles, massive, calcareous; (till) (samples at 5-ft intervals from 40–60 ft)	25	7.5
Delavan Member *Clay loam diamicton*, dark gray brown, few pebbles, massive, calcareous; (till) (samples at 65, 70, 75 ft)	15	4.6
Glasford Formation		
Undivided *Loam diamicton*, gray brown, few pebbles, massive, calcareous; (till) (sample at 80 ft)	2	0.6
Total	80	24.4

*Unit of original field measurements

Core 7815, Commonwealth-Edison B-4, La Salle Co. 40

Reference section for the Yorkville Member of the Lemont Formation. Core chips in ISGS samples library; grain size and clay mineral data on file.

Site characterization boring for Commonwealth-Edison power plant. NE NE NE Section 17, T32N, R5E, Marseilles 7.5-minute quadrangle, La Salle County, Illinois. Surface elevation 710 feet (213 m). Core chips description by J. P. Kempton and M. M. Killey (ISGS), 1975.

Lithostratigraphic Unit	Thickness ft*	m
Peoria Silt		
Clayey silt, black, trace sand, leached; (loess with modern soil developed upper part) (samples at 2.5, 5.5 ft)	8±	2.4
Lemont Formation		
Yorkville Member *Clayey silt diamicton*, gray brown, trace gravel, calcareous; (till) Dwight mineralogical zone (sample at 10.5 ft)	10±	3.0
Clayey silt to silty clay diamicton, gray brown to brown gray, little gravel, slightly sandy, calcareous; (till) Lower Yorkville mineralogical zone (samples at 5-ft intervals, 25.5– 85.0 ft)	70±	21.3
Tongue of Equality Formation (proglacial Yorkville)		
Clay, silty, gray to light gray, faintly bedded, scatteredgranules, trace sand, calcareous; (lacustrine sediment) (samples at 90, 95 ft)	10±	3.0
Batestown Member		
Silty clay loam diamicton, brown gray, slightly gravelly, calcareous; (till) (samples at 100, 105 ft)	10±	3.0
Silty, gravelly, medium to coarse sand, calcareous; (ice contact sediment) (sample at 110 ft)	5±	1.5
Silt clay loam diamicton, dark brown gray to gray, slightly gravelly, calcareous; (till) (samples at 115, 120, 125 ft)	15±	4.6
Tongue of Henry Formation (proglacial Batestown)		
Silty fine to medium sand, brown gray, very dense; (outwash ?) (sample at 130 ft missing)	5±	1.5
Tiskilwa Formation		
Piatt Member *Silt loam diamicton*, dark brown gray to red brown, slightly gravelly, variable textured, calcareous; (predominantly till) (samples at 5-ft intervals from 135–160 ft)	30±	9.1
Undivided		
Silt loam diamicton, brown gray, slightly gravelly, calcareous; (till with incorporated shale) may be Glasford Formation (sample at 165 ft)	5±	1.5
Pennsylvanian System		
Claystone, yellow gray, leached; (sample at 170 ft)	2.5	0.7
Total	170.5	51.6

*Unit of original field measurements

Cottonwood School Section

Reference section for the Roxana and Peoria Silts. Willman and Frye 1970.

Located in roadcuts. Center E line, Section 11, T18N, R11W, Clear Lake 7.5-minute quadrangle, Cass County, Illinois.

Replace Peoria Loess with Peoria Silt; Farmdale Soil with Farmdale Geosol.

Core Cross Section, Southern Lake Michigan

Type section for the Lake Michigan Member of the Equality Formation. Lineback et al. 1970.

Cross section from west to east of cores 148, 147, 146, 145, 144, 143, 118, 117, 116, and 112, located between about 20 to 32 kilometers (12–19.2 mi) east of Waukegan, Illinois, at latitude 42°21.8′N, longitude between 87°34.5′N and 86°41.4′W, water depth 64 to 119 meters (211–393 ft).

Replace Waukegan, Lake Forest, and Winnetka Members, Lake Michigan Formation with Lake Michigan Member, Equality Formation; Sheboygan and South Haven Members, Lake Michigan Formation and Carmi Member, Equality Formation with Equality Formation; Wadsworth Member, Wedron Formation with Wadsworth Formation.

Danvers (Rock Creek) Section

Reference section for the Tiskilwa Formation, the Delavan Member of the Tiskilwa Formation, the Morton Tongue of the Peoria Silt, the Robein Member of the Roxana Silt. Frye et al. 1962.

Located in cutbank on south side of Rock Creek. NW NE NW Section 32, T25N, R1W, Danvers 7.5-minute quadrangle, Woodford County, Illinois.

Replace Bloomington Moraine with Tiskilwa Formation; Bloomington Moraine gravel with Ashmore Tongue, Henry Formation; Shelbyville Moraine with Delavan Member, Tiskilwa Formation; Morton Silt with Morton Tongue, Peoria Silt; Farmdale peat and silt with Robein Member, Roxana Silt.

Delavan Section

Type section for the Delavan Member of the Tiskilwa Formation. Roadcuts, no longer exposed. Willman and Frye 1970.

Located in roadcuts along Illinois Highway 121, 4 miles (6.4 km) east of Delavan. SW Section 16, T22N, R3W, Emden 7.5-minute quadrangle, Tazewell County, Illinois.

Replace Richland Loess with Peoria Silt; Delavan Till Member, Wedron Formation with Delavan Member, Tiskilwa Formation.

Emerald Pond Section

Type section for the Batestown Member of the Lemont Formation. Partly overgrown and poorly exposed. Johnson et al. 1971b, Johnson et al. 1972.

Located along gravel road parallel to east valley bluff of the Middle Fork Vermilion River. SW SW Section 33, T20N, R12W. Danville NW 7.5-minute quadrangle, Vermilion County, Illinois.

Replace Richland Loess with Peoria Silt; Snider Till Member (till), Wedron Formation with Yorkville Member, Lemont Formation and Snider Till Member (silt, sand, and gravel) with tongue of Henry Formation; Batestown Till Member, Wedron Formation with Batestown Member, Lemont Formation; Glenburn Till Member, Wedron Formation with Delavan Member, Tiskilwa Formation.

Farm Creek Railroad Cut Section

Type section for the Morton Tongue of the Peoria Silt. Railroad cut, no longer exposed. Frye and Willman 1960.

Located in railroad cut, 6 miles (9.6 km) southwest of Morton, Illinois. Center, Section 31, T26N, R3W, Washington 7.5-minute quadrangle, Tazewell County, Illinois.

Replace Richland Loess with Peoria Silt; Shelbyville till with Delavan Member, Tiskilwa Formation; Morton loess with Morton Tongue, Peoria Silt; Farmdale silt with Robein Member, Roxana Silt.

Farm Creek Section

Type section for the Robein Member of the Roxana Silt. Willman and Frye 1970.

Reference section for the Wedron and Mason Groups, the Roxana and Peoria Silts, the Morton Tongue of the Peoria Silt, the Delavan Member of the Tiskilwa Formation. Leverett 1899, Leighton 1926, Willman and Frye 1970, Follmer et al. 1979.

Located on south side of Farm Creek. NE SW SE Section 30, T26N, R3W, Washington 7.5-minute quadrangle, Tazewell County, Illinois.

Replace Richland Loess with Peoria Silt; Delavan Till Member, Wedron Formation with Delavan Member, Tiskilwa Formation; Morton Loess with Morton Tongue, Peoria Silt; Robein Silt with Robein Member, Roxana Silt.

Fort Sheridan Lake Bluff Section

Reference section for the Wadsworth Formation. Clark 1986. Clark and Rudloff 1990.

Located in lake bluffs on Fort Sheridan Military Reservation. SE Section 3, T43N, R12 E, Highland Park 7.5-minute quadrangle, Lake County, Illinois.

Replace Wadsworth Till Member, Wedron Formation with Wadsworth Formation intertongued with Equality and Henry Formations.

Gardena Section

Reference section for the Morton Tongue of the Peoria Silt. Follmer et al. 1979.

Located in stream bank exposure 30 meters (99 ft) west (downstream) of Toledo, Peoria, and Western railroad bridge. NW SW NW Section 32, T26N, R3W, Washington 7.5-minute quadrangle, Tazewell County, Illinois.

Replace Delavan Till Member, Wedron Formation with Delavan Member, Tiskilwa Formation; Morton Loess with Morton Tongue, Peoria Silt; Robein Silt with Robein Member, Roxana Silt.

Glendale School Section

Reference section for the Roxana Silt and the Morton Tongue of the Peoria Silt. Follmer et al. 1979.

Located in north valley wall of a minor tributary of Farm Creek. SE SW NE Section 3, T25N, R4W, Peoria East 7.5-minute quadrangle, Tazewell County, Illinois.

Replace Morton Loess with Morton Tongue, Peoria Silt.

Haegers Bend Section

Type section for the Haeger Member of the Lemont Formation. Roadcuts, no longer exposed. Willman and Frye 1970.

Located in roadcuts along the Algonquin-Cary road, one half mile northwest of Haegers Bend. NW NE Section 23, T43N, R8E, Crystal Lake 7.5-minute quadrangle, McHenry County, Illinois.

Replace Richland Loess with Peoria Silt; Haeger Till Member, Wedron Formation with Haeger Member, Lemont Formation.

Henry Section

Type section for the Henry Formation. Gravel pits, no longer exposed. Willman and Frye 1970.

Located along Illinois Highway 29, two miles (3.2 km) north of Henry.

Higginsville Section

Reference section for the Wedron Group, the Tiskilwa Formation, the Delavan Member of the Tiskilwa Formation, the Lemont Formation, the Batestown and Yorkville Members of the Lemont Formations. Johnson et al. 1972.

Located in east valley wall of the Middle Fork Vermilion River. SW SE NE Section 26, T21N, R13W, Collison 7.5-minute quadrangle, Vermilion County, Illinois.

Replace Richland Loess with Peoria Silt; Snider Till Member, Wedron Formation with Yorkville Member, Lemont Formation; Batestown Till Member, Wedron Formation with Batestown Member, Lemont Formation; Glenburn Till Member, Wedron Formation with Delavan Member, Tiskilwa Formation; unnamed silt with Robein Member, Roxana Silt.

Kewaunee Section

Type section for the Kewaunee Formation. Mickelson et al. 1984.

Reference section for the Wedron Group, the Kewaunee Formation, the Manitowoc-equivalent Haven Member of the Kewaunee Formation, the Two Rivers Member of the Kewaunee Formation. Mickelson et al. 1984. Garry et al. 1990.

Located in lake bluff at south edge of Kewaunee. NE SE SE Section 19, T23N, R25E, Kewaunee 7.5-minute quadrangle, Kewaunee County, Wisconsin.

Kewaunee Formation intertongued with the Henry and Equality Formations including organic debris of the Two Creeks forest bed.

Land and Lakes Landfill Section

Reference section for the Wedron Group, the Lemont Formation, the Wadsworth Formation. Hansel and Johnson 1986.

Located in exposure on north side of landfill. SE SW SE Section 23, T37N, R11E, Romeoville 7.5-minute quadrangle, Will County, Illinois.

Replace Richland Loess with Peoria Silt; Wadsworth Till Member with Wadsworth Formation; Lemont drift with Lemont Formation intertongued with and underlain by Henry Formation.

Lemont Section

Type section for the Lemont Formation. Bretz 1955. Bogner 1973. Johnson and Hansel 1985, 1989.

Located in an abandoned sand and gravel pit on the south valley bluff of the Des Plaines Valley. NE SE Section 25, T37N, R10E, Romeoville 7.5-minute quadrangle, Cook County, Illinois.

Replace Wadsworth Till Member, Wedron Formation with Wadsworth Formation intertongued with Equality Formation; Lemont drift, Wedron Formation with Lemont Formation intertongued with and underlain by Equality and/or Henry Formation(s).

Mahomet I-74 Bridge Section

Type section for the Piatt Member of the Tiskilwa Formation. Overgrown and poorly exposed. Wickham 1979a.

Located in east bank of the Sangamon River, north of Interstate 74. NE SE NE Section 15, T20N, R7E, Mahomet 7.5-minute quadrangle, Champaign County, Illinois.

Replace Batestown Till Member, Wedron Formation with Batestown Member, Lemont Formation; Piatt Till Member, Wedron Formation with Piatt Member, Tiskilwa Formation; Fairgrange Till Member, Wedron Formation with Delavan Member, Tiskilwa Formation; Oakland Till Member, Wedron Formation with Oakland facies, Delavan Member, Tiskilwa Formation.a

Mahomet North Section

Reference section for the Piatt Member of the Tiskilwa Formation.

Exposure measured in east bank of creek in Champaign County Forest Preserve, Lake of the Woods Conservation Area, 0.15 mile (0.25 km) west of Illinois Highway 47, NW SW SE Section 10, T20N, R7E, Mahomet 7.5-minute quadrangle, Champaign County, Illinois. Surface elevation 710 feet (213 m). Description by Wally Morris, L. R. Follmer, and W. H. Johnson 1980; W. H. Johnson 1983.

Lithostratigraphic Unit	Thickness ft*	Thickness m
Peoria Silt		
Silt loam, platy structure grading to silty clay loam, blocky structure; leached; (A, E, and B horizons of modern soil developed in loess)	3	0.9

*Unit of original field measurements

Henry Formation		
Pebbly clay loam, sandy loam, and gravelly sandy loam; weak blocky structure in upper half; dark brown with prominent iron staining, leached and clay enriched; (lower B and *beta* horizons of modern soil developed in stratified sand and gravelly sand)	2	0.6
Tiskilwa Formation		
Piatt Member		
Pebbly loam diamicton; calcareous; upper 0.5m leached, few clay skins, root traces, and Fe-Mn concretions; lower part calcareous, yellow brown (10YR5/4 m) with gray mottles at top grading to olive brown (2.5Y5/4 m) to gray brown (2.5Y5/2) at base, yellow brown stains on joint surfaces, coarse blocky structure (subglacial till)	7.9	2.4
Interbedded sand, gravelly sand, and diamicton, few boulders; complex sediment relationships; oxidized; sand medium to fine, well sorted, most diamicton similar to diamicton above but some similar to subjacent diamicton, wavy contact with superjacent diamicton and wavy contacts within unit (subglacial till?)	1.6	0.5
Delavan Member		
Pebbly clay loam diamicton; calcareous; upper 0.25 meter dark brown (7.5YR-10YR4/3 m), few thin oxidized sand seams with changing dip and orientation, one sand seam along shear plane; lower part dark brown to dark gray brown (10YR7.54/2 m) with pink cast, coarse blocky structure; base not exposed; (subglacial till)	5	1.5
Total	19.5	5.9

Pleasant Grove School Section

Type section for the Roxana Silt. Most of section no longer available. Willman and Frye 1970.

Located in borrow pits and access roadcuts in the bluff of the Mississippi Valley, 4 miles (6.4 km) southeast of Roxana. SE Section 20, Monks Mound 7.5-minute quadrangle map, Madison County, Illinois.

Replace Peoria Loess with Peoria Silt.

Saline River Section

Type section for the Equality Formation. Bridgecut, no longer exposed. Willman and Frye 1970.

Located in streamcut 4 miles (6.4 km) southwest of Equality. SE corner SW Section 27, T9S, R7E, Rudement 7.5-minute quadrangle, Gallatin County, Illinois.

Replace Richland Loess with Peoria Silt.

Tindall School Section

Type section for the Peoria Silt. Willman and Frye 1970. Follmer et al. 1979.

Located in a borrow pit in bluff of the Illinois Valley south of Peoria. SW SW NE Section 31, T7N, R6E, Glasford 7.5-minute quadrangle, Peoria County, Illinois.

Replace Peoria Loess with Peoria Silt; Robein Silt with Robein Member, Roxana Silt.

Two Creeks Section

Reference section for the Two Rivers Member of the Kewaunee Formation. Mickelson et al. 1984.

Located in lake bluff. NE NE Section 2, T21N, R24E, Two Creeks 7.5-minute quadrangle, Manitowoc County, WI.

The Two Rivers Member is underlain by a tongue of the Equality Formation containing the Two Creeks forest bed.

Wadsworth Section Type section for the Wadsworth Formation. Roadcut, no longer exposed. Willman and Frye 1970.

Located at intersection of Illinois Highway 131 and Wadsworth Road, 2 miles (3.2 km) east of Wadsworth. SE SE SW Section 30, T46N, R12E, Wadsworth 7.5-minute quadrangle, Lake County, Illinois.

Replace Wadsworth Till Member with Wadsworth Formation.

Wedron Section Type section for the Wedron Group. Willman and Frye 1970. Willman et al. 1971. Johnson et al. 1985a. Johnson and Hansel 1990.

Reference section for the Robein Member of the Roxana Silt, and the Peddicord Tongue of the Equality Formation, the Ashmore Tongue of the Henry Formation, the Tiskilwa Formation, the Delavan and Piatt Members of the Tiskilwa Formation, the Lemont Formation, the Batestown and Yorkville Members of the Lemont Formation, intertonguing relationships of the Tiskilwa and Lemont Formations of the Wedron Group with the Henry and Equality Formations and the Peoria Silt of the Mason Group. Willman and Frye 1970. Johnson et at. 1985a. Johnson and Hansel 1990.

Located in highwalls of pits in Wedron Silica Company quarries. Sections 8, 9, 10, and 16, T34N, R4E, Wedron 7.5-minute quadrangle, La Salle County, Illinois.

In Willman and Frye 1970, replace Richland Loess with upper tongue, Peoria Silt; Wedron Formation with Wedron Group intertongued with Henry and Equality Formations, Mason Group; Malden Till Member, Farm Ridge Drift with Yorkville Member, Lemont Formation underlain by tongue of Henry Formation; Malden Till Member, Mendota and Arlington Drifts with Batestown Member, Lemont Formation underlain by tongue of Equality Formation; Dover Drift of Malden Till Member with Piatt Member, Tiskilwa Formation; Bloomington Drift of Tiskilwa Till Member with Tiskilwa Formation (undivided); Lee Center Till Member with Delavan Member, Tiskilwa Formation underlain by Ashmore Tongue, Henry Formation; Robein Silt with Peddicord Tongue, Equality Formation.

In Johnson and Hansel 1985, replace Richland Loess with Peoria Silt; Wedron Formation with Wedron Group intertongued with Henry and Equality Formations, Mason Group; Malden Till Member, unit 3 with Yorkville Member, Lemont Formation underlain by tongue of Henry Formation; Malden Till Member, unit 2 with Batestown Member, Lemont Formation underlain by tongue of Equality Formation; Malden Till Member, unit 1 with Piatt Member, Tiskilwa Formation overlain by tongue of Equality Formation; Tiskilwa Till Member, main unit with Tiskilwa Formation (undivided); Tiskilwa Till Member, lower unit with Delavan Member, Tiskilwa Formation; Peddicord Formation with Ashmore Tongue, Henry Formation underlain by Peddicord Tongue, Equality Formation; Morton Loess with Morton Tongue, Peoria Silt; Robein Silt with Robein Member, Roxana Silt.

In Johnson and Hansel 1990, replace Richland Loess with Peoria Silt; Wedron Formation with Wedron Group intertongued with Henry and Equality Formations, Mason Group; Malden Till Member, sequence III with Yorkville Member, Lemont Formation intertongued with Henry Formation; Malden Till Member, sequence II with Batestown Member, Lemont Formation underlain by tongue of Equality Formation; Tiskilwa Till Member, facies F with tongue of Equality Formation; Tiskilwa Till Member, facies E and D2 with Piatt Member, Tiskilwa Formation; Tiskilwa Till Member, facies D1 with Tiskilwa Formation (undivided); Tiskilwa Till Member, facies C with Delavan Member, Tiskilwa Formation; Peddicord Formation, facies B with Ashmore Tongue, Henry Formation; Peddicord Formation, facies A1 with Peddicord Tongue, Equality Formation; Robein Silt with Robein Member, Roxana Silt.

Yorkville Section Type section for the Yorkville Member of the Lemont Formation. Willman and Frye 1970.

Located in roadcut at intersection of Illinois Highways 71 and 47, 1 mile (1.6 km) south of Yorkville, SE SE SE Section 5, T36N, R7E, Plattville 7.5 minute quadrangle, Kendall County, Illinois.

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